MEMBER AUDIT BUREAU OF CIRCULATIONS

THE WELDING ENGINEER

Vol. 22. No. 3 MARCH, 1937

MAIN CONTENTS OF THIS ISSUE

SMOKESTACKS
Welding and Erecting 150-Ft. Stacks (Wurst) 19

UNDERWATER CUTTING
Torch-Carrying Divers at Bonneville (Young) 20

DREDGE
Welded Construction for First All-Steel Oyster Dredge (Depew) 22

METALLURGY
Metallurgical Problems of Welding in the Automobile Industry (Di Giulo) 25

PENETRATION
Penetration (Ronay) 30

MACHINERY
Economical Fabrication of Ore-Treating Equipment (Conly) 32

BRIDGE
Canada's Largest All-Welded Bridge (Davis) 34

Editorial 17
Ford Orders Two New Welded Motor Ships 23
Fleet of Huge Dredges Have Welded Hulls 23
Utility Company Cuts Field Welding Costs 23
New Orders for Welded Stainless-Steel Cars 23
Educational Lecture Course on Structural Welding 23
Welding News in Pictures 24
Program Announced for Iowa Welding Conference 29
London Subways' Noise Problem Solved by Welding 33
Woman Welder Says Her Sex Is Discriminated Against 35
A. S. M. E. Meeting Will Have Papers on Welding 35
Shop Turns Out "New Deal" Angleometer 35
Chart for Finding Allowable Loads on Welded Joints 36
High Steel Prices Stimulate Welding Activity 37
Adopts Welding for Ladders and Other Types of Frames 37
Get "H. O. T." on Welding 38
Book Reviews 39
Meetings 40
Coming Events 40
What's New in Equipment and Supplies 41
Trade Literature 44
Commercial News 46
Notes From the Field 48

G. H. MACKENZIE, *President and Treasurer*
F. L. SPANGLER, *Editor* L. C. MONROE, *Advertising Manager*

Representatives

EASTERN: T. E. Depew, American Circle Bldg., New York, N. Y. Tel. Columbus 5-7843. PACIFIC COAST: W. R. McIntyre, Architects Building, Los Angeles, Calif. Tel. Michigan 2561.

Published on the 15th of each month by the Welding Engineer Publishing Company, 608 S. Dearborn St., Chicago, Ill. Telephone Webster 7134.

Subscription, payable in advance: United States and possessions, and Canada, $3 a year; Foreign Countries, $4 a year; Single copy, domestic, 25 cents; Single copy, foreign, 35 cents. Entered as second-class matter January 20, 1916, at the postoffice at Chicago, Illinois, under the act of March 3, 1879.

FOREIGN REPRESENTATIVES: AUSTRALIA and NEW ZEALAND—R. Hill, Matlock House, Davenport, Auckland, New Zealand; GREAT BRITAIN—A. D. Baynes, 6, Mordaunt House, Larkhall, Clapham, London, S. W. 8, England; SOUTH AFRICA—J. W. Arnison, 35a Victoria Avenue, Benoni, Transvaal, South Africa; JAPAN—Maruzen Company, Ltd., 6, Nihonbashi, Tori-Nichome, Tokyo, Japan; U. S. S. R.—Mesdunarodnaja Kniga, Kusnezkij Most 18, Moscow, U. S. S. R.

YOU CAN DO IT BETTER WITH

20 YEARS OF LEADERSHIP

★ 1917...1937 ★

MARCH marks another milestone in the manufacturing leadership maintained by TORCHWELD EQUIPMENT COMPANY during the past twenty years . . . always a pioneer in new development, Torchweld has the most complete line of welding and cutting equipment in its history; a line that is completely modern and advanced in design, whose labor-saving features establish it as a money-maker in its field. We will continue in the future, as we have in the past, to build the finest welding and cutting equipment. At this time it seems proper that we express a word of appreciation to the many concerns whose patronage has made it possible for us to manufacture quality equipment for the Oxy-Acetylene Welding and Cutting Industry.

Write today for further information regarding TORCHWELD EQUIPMENT!

TORCHWELD EQUIPMENT COMPANY
1035 WEST LAKE STREET CHICAGO, ILLINOIS

INDEX TO ADVERTISERS

	Page
A	
Adams Co., J. D.	Inside Front Cover
Air Reduction Sales Co.	8
Aladdin Rod and Flux Mfg. Co.	58
American Agile Corp.	57
American Brass Co.	43
American Steel and Wire Co.	13
American Welding Society	45
Anti-Borax Compound Co.	54
Arcos Corp.	58
B	
Bastian-Blessing Co., The	Front Cover
C	
Central Steel and Wire Co.	Inside Back Cover
Chicago Hardware Foundry Co.	56
Chicago Steel and Wire Co.	53
Churchward Engineering Co.	Back Cover
Classified Ads	52
Colmonoy, Inc.	49
Commercial Acetylene Supply Co.	53
D	
Dockson Co., C. H.	48
Douglass Pipe Machine Co.	58
E	
Eisler Engineering Co.	58
F	
Faulk, F. R.	54
G	
General Electric Co.	14
H	
Harnischfeger Corp.	54
Hobart Brothers	3
I	
Ideal Face Shield Co.	56
Imperial Brass Mfg. Co.	53
J	
Jackson Electrode Holder Co.	57
L	
Lincoln Electric Co., The	7
M	
Manganese Steel Forge Co.	53
Metal and Thermit Corp.	15
Metal Bond Mfg. Co.	54
Milburn Co., The Alexander	54
N	
National Carbide Corp.	53
New Process Plow Welding Co.	52
Northeast Metals Co.	54
O	
Okonite Co., The	51
P	
Page Steel and Wire Co.	16
Pierce Governor Co.	Inside Back Cover
R	
Revere Copper and Brass, Inc.	54
Roebling's Sons Co., J. A.	4
Ryerson & Son, Inc., Jos. T.	47
S	
Safety Gas Lighter Co.	54
Shawinigan Products Corp.	54
Shoot-A-Lite Corp.	54
Steel Sales Corp.	53
Stoody Co.	13
Stulz-Sickles Co.	54
T	
Titan Metal Mfg. Co.	56
Torchweld Equipment Co.	6
U	
U. S. Steel Corp. Subsidiaries	11
V	
Victor Equipment Co.	12
W	
Weldon Roberts Rubber Co.	54
Westinghouse Electric and Mfg. Co.	10 and 11
Wilco Co.	54
Wilson Welder and Metals Co.	9

★ ★ ★

EDITORIAL

★ ★ ★

Round-Table Discussion Groups

BECAUSE of a number of recent marked successes in the holding of round-table discussions on welding and cutting topics, some of those responsible for meetings and conferences are looking with favor on this type of educational gathering.

Round-table discussions have been particularly successful where the group was not large in numbers—generally not exceeding about 40.

Where an informal group of this kind is made to feel at ease, discussion is spontaneous, and there is a noticeable freedom in the asking for and giving of information.

Where the round-table plan has been carried out, the larger group is divided into several smaller groups, each devoted to a discussion of some specific topic. Anyone is allowed to join the group in which he will find his greatest interest. If time permits, it is also possible to have the members move around among the groups, each such change being made at stated times so there will be no interruption during the regular periods of discussion.

From the standpoint of the listener, this method has obvious advantages over the usual kind of meeting, in which there is one or two talks covering an entire evening, only a small part of which might be of direct interest or concern to the listener, who is obliged to sit through the entire meeting.

Whether a round-table discussion is successful depends in large measure on the handling of the discussion by the chairman of the group.

The chairman must have the qualities of a good attorney-at-the-bar. It isn't so necessary that he know a great deal about the subject matter—in fact, if he considers himself an expert on the topic assigned his group he may be apt to lecture, thereby turning the discussion into a monologue.

But he should keep the discussion strictly within the bounds of the topic assigned the group, since it is an easy matter for one or a few among those present to ramble off into another field. Moreover, he should have the knack of bringing out questions from his group and of inducing those in the group to inject testimony into the proceedings.

He should recognize the common-sense limits of discussion so as to prevent statements that smack of commercialism or that show maliciousness on the part of the speaker.

His biggest job is to prevent a monopolization of time on the part of any individual or group that is not representative of the entire group itself.

The group chairman is the king-pin in this matter. Like the captain of the ship at sea, he should be given full and complete authority in his group, but, by the same token, he should be chosen only after his traits and character show that he will conduct himself in accordance with the responsibilities imposed.

If the advantages of round-table discussions with small informal groups were fully understood, there would be more of them. Those who have organized them successfully are greatly enthused over their advantages and possibilities. They have been successfully tried by a few American Welding Society Sections, national organizations and welding conferences. But, the important thing to remember is, Select the proper group chairman. Not many are qualified for that job.

FABRICATED *with Murex*

. . . because Murex fills the bill where welding is a production job

Whitehead & Kales Co., Detroit, specializes in the fabrication of frames and bases such as the broaching machine frames in the accompanying illustration.

Here, arc welding is a strictly production operation with costs carefully watched, with schedules to be adhered to, and with the highest quality to be maintained in all welding operations.

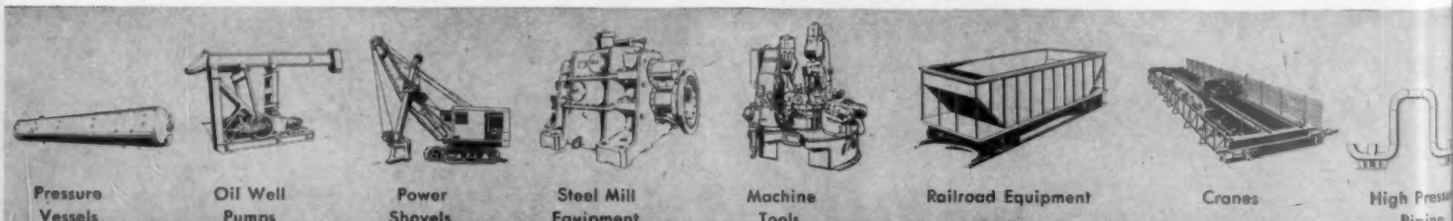
In this plant, as in many others where so much depends on the electrodes employed, Murex Electrodes are consumed by the carload.

Used at higher current strengths, Murex Electrodes keep down welding costs by depositing more metal per hour. At the same time, the all-mineral Murex coating, instead of going entirely to slag, actually contributes to the weld metal, producing more deposit per pound of electrodes. And, the complete protection given both to the arc and the molten deposit results in uniformly sound and remarkably smooth welds that require a minimum of cleaning.

We've a booklet that gives the whole story. Write for your copy today. Metal & Thermit Corporation, 120 Broadway, New York. Albany, Chicago, Pittsburgh, So. San Francisco, Toronto.

MUREX

. . . . HEAVY COATED ELECTRODES



Pressure Vessels | Oil Well Pumps | Power Shovels | Steel Mill Equipment | Machine Tools | Railroad Equipment | Cranes | High Pressure Piping

LEADING MAKERS WELD THESE PRODUCTS WITH MUREX FOR QUALITY AND ECONOM

The Welding Engineer

VOLUME XXII MARCH, 1937 NUMBER 3

Welding and Erecting 150-Foot Stacks . . . .

By F. L. WURST
Chicago Brdge & Iron Co.

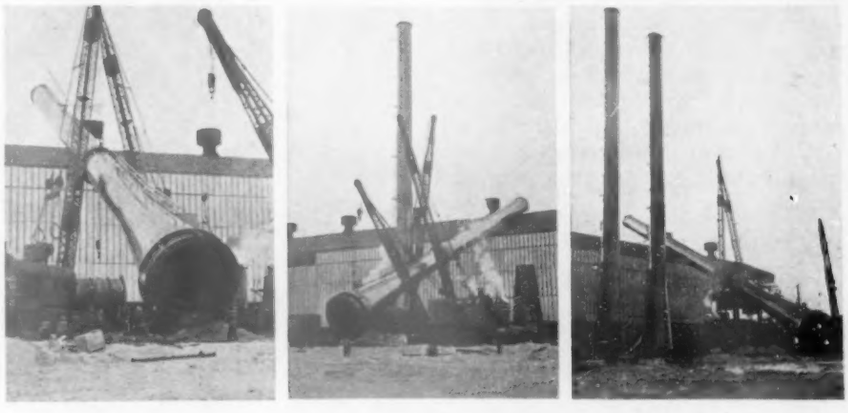
THREE butt-welded self-supporting steel smoke stacks, each weighing approximately 64,000 lb., including its ladder, and 150 ft. high by 7 ft. 6 in. in diameter, were recently erected near Chicago.

Being a part of a vast expansion program, the erection of these stacks had to fit in with our customer's construction schedule. The customer specified that the stacks be shop-welded as much as possible so as to reduce the time of field assembly to the minimum.

Each stack was, therefore, shop-welded and shipped in seven pieces. The cylindrical portion of each stack was shipped in two 60-ft. lengths, being fabricated from 3/8-, 5/16- and 1/4-in. plate. The upper 15 ft. of the bell (3/8-in. plate) was shipped in one piece, and the lower 15 ft. of the bell (7/16-in. plate) had to be shipped in four pieces because of its size.

The stacks were assembled, field welded and painted in a horizontal position on blocking adjacent to the stack foundations, and erected intact. The actual time involved in erecting the first stack was 1½ hours. This included all time required to complete all rigging, block up the outriggers on the cranes, and fasten the anchor-bolt nuts after the stack was set in place. The second stack was erected in 45 minutes and the third stack in 28 minutes—actual time to do the same amount of rigging, blocking, etc. as was done for the first stack.

These stacks were somewhat unusual in that all lining angles on the inside had to be omitted in order to accommodate a certain spiral lining. The cylindrical portion of the stacks was light; in fact, it was too thin to erect as we did without some diaphragm or reinforcing at the point where the hitch was made. This, coupled with the fact that there were three stacks to erect at this location, influenced our decision to design a special hitch collar which would serve two purposes—first, to reinforce the stack, thus enabling us to erect it in one piece, and, second, to facilitate the hitch to the stack considering the cramped working space.



Progress Views Showing Erection of Smokestacks.

The hitch collar served this purpose well. It could be clamped to a stack in a matter of minutes, whereas the usual method of lashing a hitch to the stack with cables and plank lagging frequently takes hours, to mention nothing of the additional time that would be required to build a temporary diaphragm inside to resist the crushing action of the lash-hitch. This hitch collar also kept the tackle blocks clear of the stacks. There was no interference or binding of the blocks, as frequently happens with lash-hitches. These stacks were not dented or marred by the blocks or crane booms during erection. In fact, the paint was not even scratched.

Another feature attributed to the hitch collar was the fact that the stacks hung perfectly plumb from both cranes and were easily lowered over the foundation bolts without the customary pulling, tagging, etc. usually required when lash-hitches are used.

We had originally made plans to use two locomotive cranes for erecting each stack and would have done so had it not been for the fact that, a few days before the first stack was ready to erect, the customer's men unloaded some 200,000 lining bricks and vast quantities of sand and cement directly in the way. The customer found it much more desirable to furnish a third crane rather than move the vast quantity of lining material out of the way. The third crane was used to ease the bell of the stack over this lining material.

(Editor's Note: The 104-ft. smoke stack recently erected in Peoria, Ill., and described on page 37 of the December, 1936, issue of The Welding Engineer, did not set a new record for size of all-welded stacks, since each of the three stacks described above are much larger in height and girth.)

Torch-Carrying Divers at Bonneville...

By HENRY W. YOUNG

THE casual observer who makes his way around over the Bonneville project, and gets down to the water level amidst the apparent snarl of barges, pile drivers, cranes and whatnot that nuzzle up to the north-side cofferdam, now nearing completion, will somewhere come upon a little barge that will cause him to pause through curiosity. On this barge are half a dozen men, paying out lines of rope and hose and studying the water intently. Lined up in the middle of the barge are a great number of gas containers or "bottles," some of them connected through pressure control valves with the hose line in the water. This is headquarters of the diving crew. Somewhere below, in 60 ft. of water, a diver is at work. While a thousand men may be swarming over the work above, engaged in numberless tasks, only two men ever get to the "real bottom of things." They are C. O'Donnell and R. H. Vance, of the partnership, O'Donnell & Vance, divers and submarine contractors.

The Torch Is Indispensible to the Diving Contractor

O'Donnell & Vance have contracts by the year to do all the diving work in connection with building the dam. These contracts are with the U. S. Engineers and with the Columbia Construction Co., which latter is building the spillway part of the dam. These two men did some of the diving, under contract, on the San Francisco-Oakland Bay Bridge. They have done submarine work on construction jobs and other locations not only throughout the United States but in practically all parts of the world.

As in practically every other class of contracting and construction work, the torch has become a recognized and almost indispensable tool for the diving contractor. While he has not yet been able to weld successfully under water, it is reasonable to suppose that it may come. In the meantime, he cuts almost as readily under water as on the surface. A few examples of the problems that he meets on a large construction job such as Bonneville dam will serve to demonstrate that fact.

The Submarine Torch Is Lighted and Then Lowered to the Diver.

Going Down in 60 Ft. of Water to Get the "Low Down" on That Pile-Driving Problem.

Diver Vance Coming Up from an Underwater Cutting Job.

The first example has to do with the driving of the interlocking sheet-steel piling on the east (up-stream) side of the north-side cofferdam. This piling is driven as an outer, watertight facing to the timber cribs that are sunk to the bottom of the river and filled with rock. Before sinking, the cribs are towed to their exact position and held there by 2-in. steel cables.

Diver Cuts Fouled Cable on Crib

In the case of the crib under consideration, one of the towing cables attached some 13 ft. from the top was lost in the river and became fouled there. One end still remained attached to the crib and would prevent driving the steel pile at that point. The job of Diver Vance was to go down and cut this end off.

The torch that Vance employed is of the Victor submarine type, with a special hood designed with the assistance of Barten Carter of the Columbia Construction Co., and perfected as the result of practical tests made by O'Donnell & Vance on this job.

The hood over the tip is so designed as to achieve unusually good results in distributing the compressed air coming from the tip. The flame burns in this cone-shaped air space or bubble and the torch may then be operated for cutting just as it would be above water.

A Large Part of the Space on the Divers' Raft Is Taken Up by Oxygen, Hydogen and Compressed-Air Cylinders.

The cutting speed is approximately 80% of that with an ordinary torch at the surface. Bottled compressed air is used, since this is drier and cleaner than that which would come from compressed-air lines. The air pressures employed are approximately ½ lb. to each foot of depth.

This torch, with the special hood, is designed for operation at depths around 50 ft., though torches are now available with underwater depth capacity beyond 200 ft. When the diver is down and all is ready, the torch is lit on the surface and the compressed air turned on, as he has already determined the depth so that the pressure of the air can be properly adjusted. The torch is then lowered to him.

Another vexatious job often turns up for the diver whenever an obstruction is met and the driving crew finds that a pile will suddenly go no farther. It then is necessary for the diver to go down, locate the point of the pile and find out what is in the way. If it is a metal obstruction of some kind, it might possibly be burned away, and down goes the torch for that purpose. Certain other obstructions may be removed by tackle placed by the diver and operated from above. Or, if the pile is a wooden one, a metal point might be the solution.

Cutting Off and Salvaging Sheet-Metal Piling

There are a great many under-water cutting jobs to be done in connection with the interlocking sheet-metal piling that is driven completely around the outer face of the cofferdam crib. In one case, a solid row of 107 piles had been bent over by the force of the current. It was impossible to pull them with the pile puller, in spite of its tremendous capacity of 250 tons on a direct pull. The only thing to do, then, was to cut them off at the mud line and salvage the upper portions. It was the job of the diver to go down in 45 ft. of swift water and cut them off. The cut-off ends are welded together to make full-length piles, or they are sold to dealers who buy this class of junk, at a price of $2.50 per lineal foot of pile.

The above illustrations represent only a few out of the many occasions around a great construction job of the character of Bonneville where the diver with his ever-ready submarine torch is performing intricate, not to say hazardous, tasks under water. The depth here is not great enough to be a detriment, and he goes up and down without delay, and no time out for decompression. His greatest hazard lies in the debris and entangling obstructions that he encounters below—rocks, piles, waterlogged timbers, cables and a hundred and one other things, not to mention small bits of equipment such as 10-ton trucks, bulldozers, steam shovels and now and then a crane that the contractor occasionally drops into the river.

On a big job like this, involving scores of millions of dollars, time is a great element. The work must go on at the greatest speed possible and at the same time ordinary care must be taken with the equipment. But there can be no fiddling around about it. If a steam shovel happens to fall in, it is too bad, of course. But hurry up another to take its place and fish the lost one out when there is time. These things have all happened at Bonneville more than once. Just now a large whirley crane reposes in the bottom of the north-side cofferdam area, and is completely covered with mud and silt, so the divers report. It will remain there until the cofferdam is unwatered and is being excavated. In due time it will show up, be reconditioned and be put to work again. But in the meantime it causes no more worry to the big contractor than a lost wheelbarrow might to the little fellow who does odd jobs.

Diver O'Donnell Examines His Torch.

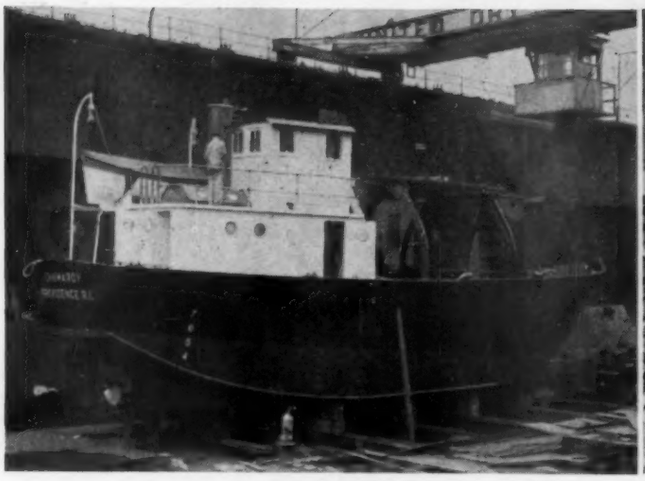
It is another duty of the diver to go down and find this lost equipment, report its position and how it lies. If possible, he gets tackle onto it so that it can be raised at once. This last is not so difficult as it looks, for there are great cranes at work all over the job, barges with massive shear legs operated by powerful winches, the mighty walking dragline which toys with 10-yard buckets full of rock on the end of a 100-ft. boom; and over all is the twin cableway across the river. Between them all, they can fish out most anything that the contractor drops into the river, if they can get hold of it.

Even the Diver's Very Life Might Depend on the Torch

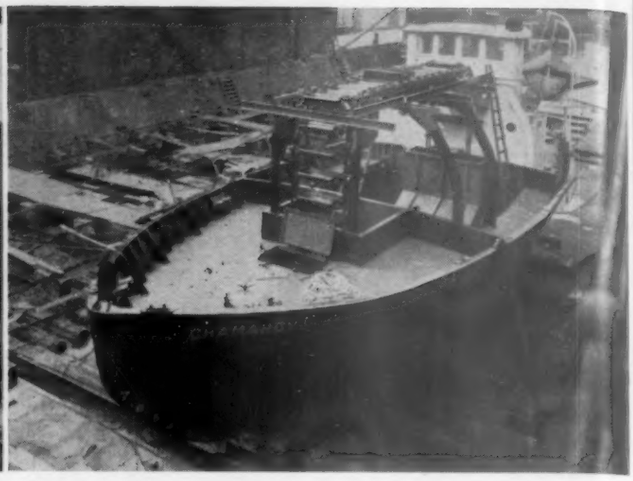
But the diver is just one man in a clumsy suit and a metal "hat." He must go down there alone, to direct the work and place the rigging. Not only is it a great help to him to have the torch to cut away metal obstructions and place the tackle, but it eases his mind to know that a word over the telephone will bring this flaming tool down to him, and that if he or his lines should get caught in metal work, the torch will be at hand to release him and save his life.

Starts Construction of 25 All-Welded Barges

The Dravo Corp., of Pittsburgh, Pa., has begun the construction of 25 all-welded steel barges for the Wheeling Steel Corp., Wheeling, W. Va. These barges, which will be 140 ft. long, 26 ft. wide and 10 ft. deep, will be used to haul coal from the steel corporation's mines in the Pittsburgh district to their various plants in the vicinity of Wheeling. All these barges will pass through the new shop of the Dravo Corp., which is capable of handling three units in the production line at one time. As a result, the order is expected to be completed early in the Spring.



The "Chamaroy," Showing Seabright Box Stern.



The Conveyor System Has an Automatic Dumping Point on Top and the Well Underneath.

Welded Construction for First All-Steel Oyster Dredge . . .

By T. E. DEPEW
The Welding Engineer

AN IMPRESSIVE example of the use of steel and welding combining to make possible an increase in efficiency of operations of an important, old-established industry, is found in the *Chamaroy,* the first oyster dredge employing welded steel construction throughout, built by the Truss-Weld Division of United Shipyards, Inc., for the Narragansett Bay Oyster Co. The vessel was launched from the Crane 27th Street Plant of United Shipyards, in Brooklyn, N. Y., on March 10, and is understood to represent the first use of all-steel construction in place of wood, in vessels of this type. This vessel is also said to mark a substantial advancement in the art of oyster dredging, including a reduction in the amount of laborious work now characterizing oyster-dredging operations, together with an improvement in the condition of the oyster cargo delivered to the opening house.

Construction Allows Washing the Well Down Clean

The *Chamaroy's* cargo well employs the "Free Flow Frame" system of construction, developed by Johannes Kjekstad, consulting engineer for United Shipyards, Inc., the features of which were described in detail in *The Welding Engineer* of December, 1935. An especial advantage of the "Free Flow" type of framing in this instance is that its use makes possible the washing down very clean of the well. The vessel was designed by Mr. Kjekstad and C. K. Pevear of the United Shipyards, Inc., in collaboration with officers of the Narragansett Bay Oyster Co.

The vessel possesses a forward section similar in shape to a bank dory, with considerable shear, flaring sides and flat bottom which carries out into a spoon bow. The stern section is similar to a Seabright sea skiff with a box stern and flat bottom.

Oyster Load Is Carried in Open Well

The *Chamaroy* is 65 ft. overall and 20 ft. wide across the deck amidships and will draw 4 ft. light and 6 ft. 3 in. loaded with 80 tons, or approximately 2,000 bushels, of oysters. The load is carried in an open well amidships 19 ft. long and running the entire width of the vessel. The bottom of this well is two feet above the bottom of the vessel and is removable, thus allowing a pivoted bucket conveyor to operate under the bottom plates of the well, through the forward bulkhead, up the forward conveyor well and over the superstructure, which primarily is required to support it, and then down the aft conveyor well, which is part of the cargo well although separated by steel bulkheads, and thus completing the cycle.

This conveyor, with buckets 2 ft. 6 in. wide, 18 in. long and 9 in. deep, is loaded by first opening the lower of a series of small doors in the forward bulkhead, thus allowing the oyster cargo to flow into the moving buckets as they come out from under the floor of the well. When the flow ceases through the lower door, the upper doors in succession are opened until the opening is clear; then the plates in the floor immediately above the conveyor are moved forward one at a time, from forward to backward, thus feeding 70% of the cargo without manhandling; the remainder, that part of the cargo which clings to the sides, can easily be shoveled onto the steel floor plates to the conveyor. The capacity of the conveyor is 80 tons per hour, which permits unloading of the cargo in approximately one hour.

Bucket Conveyor Dumps Cargo Onto Belt Conveyor for Unloading

When the full buckets arrive at a fixed point above the superstructure, they are automatically dumped onto a portable belt conveyor, which carries the load ashore. If unloading of the vessel at sea is required, for operations such as transplanting or planting cultch or shell, the dumping point of the buckets is sufficiently high so that chutes from the dumping point to the rail will carry the cargo overboard.

The vessel is driven by a 120-hp. 1,200-r.p.m. diesel, through a 3-to-1 reduction swinging a 44-in. three-bladed propeller. The dredge hoisting machinery and a 4-in. 200-gallon-per-minute capacity pump with other auxiliaries is driven by a 30-hp. diesel.

The large pump is to be used to partially fill the well with water so that the first half of the dredged oysters will have their fall broken by the water; this water will also have a considerable

cleansing effect on the oysters, washing down the mud, fines and sand into the space below the floor. The piping of this pump is so arranged as to discharge the water from the well or throw a large stream on the oysters.

The usual dredges will be used, but they will be staggered instead of opposite each other, with the starboard one forward, the port one aft, thus aiding in the trimming of the load. The dredge chain sheaves will be attached to the thwartship steel girders of the superstructure, thus allowing adjustment of the chain angle. The dredge hauling equipment will be located in a watertight steel-walled room above the deck and directly below the pilot-house, with the dredge chains leading through the forward bulkhead in hawse pipes. The conveyor will be driven by a chain from the jack shaft driving the dredge equipment, with the necessary clutch and pilot-house controls.

Ford Orders Two New Welded Motor Ships

Two new canal motor ships, the largest of their kind ever built for service between the Great Lakes and the Atlantic Coast (via New York State Barge Canal), will be added to the Ford Motor Co.'s fleet in June.

The vessels, now under construction at River Rouge, are to ply between the Ford Rouge Plant at Dearborn, Mich., and the company's plants at Edgewater, N. J., Chester, Pa., and Norfolk, Va. The first is scheduled to go into service about June 1 and the second about June 15.

It is claimed that they will be the first freight carriers on the Great Lakes having no riveting in the hull and deck construction. Welding is being used throughout. Each will be driven by two 600-hp. diesel engines and will carry a crew of 18 men. They are stern driven, with a three-to-one gear reduction from engine to propellor.

These craft will be equipped with the latest devices and apparatus for navigation control. They will be 300 ft. long, and have a 43-ft. beam and 20-ft. depth. They are being built as large as possible in keeping with the length and width of locks in the New York State canal system through which they will go.

In many respects the new marine carriers will be much like the *Chester* and *Edgewater*, two sister ships of the Ford fleet used for canal trade, which were the largest geared turbine-propelled steamers in the world when constructed for Ford in 1931. They will have a disappearing superstructure, to permit passage beneath Erie Canal bridges. The pilot house will rest on a hydraulic lift, to be lowered or raised as desired. Funnels will be tilted, and masts will be raised and dropped within pipes so that the ships will be able to pass beneath bridges only 15 ft. above water level.

The new boats will have a freight capacity of 2,200 tons, slightly exceeding that of the *Chester* and *Edgewater*. This will enable each to carry nearly 2,000 V-8 engines with all axles and heavier parts necessary for assembling 2,000 Ford cars or trucks. They will have a speed of 11½ knots per hour.

Fleet of Huge Dredges Have Welded Hulls

The *Thompson*, seventh of a fleet of super-dredges, many parts of which are of welded construction, was launched last month in the shipyards of the Dravo Corp., on the Ohio River near Pittsburgh, Pa. Miss Louise Thompson, of Minneapolis, Minn., grand-daughter of William A. Thompson, after whom the dredge is named, sponsored the launching. She was accompanied by her father, Alexander M. Thompson, secretary-treasurer of the LaCrosse Dredging Co., Minneapolis.

This dredge, built at a cost of $750,000, is 230 ft. long, 48 ft. wide and 8½ ft. deep. It is of the twin-screw funnel type and will pump, under average conditions, from 1,500 to 2,000 cu. yd. of sand and gravel per hour.

The hull and interior portions of this huge craft, as well as the bases and housings for the gear drums, and the exhaust manifold leading from the engine to the stack, all are of welded construction. All-welded tanks for the lubricating system, welded mufflers and welded stacks are also used.

After completion, the dredge will be turned over to the U. S. Army Engineers of the St. Paul district, and will leave Pittsburgh under its own power for the upper Mississippi River, where it will be placed in operation. The eighth dredge of the fleet, to be built for the Rock Island district, is expected to be launched soon.

Utility Company Cuts Field Welding Costs

Most power companies have their welding problems, and in this case the Detroit Edison Co. was no exception. For their many field welding jobs they had been using 1½-ton trucks with gas-driven welders mounted on the body platform. The welder and truck costs, together with that of the labor arising from the necessity of using a truck driver and a welding operator with each unit, was so high that it resulted in a search for a lower-cost portable welder unit.

An investigation resulted in the purchase of three 150-ampere portable trailer welders. On these gas-driven welders they made suitable modifications for mounting oxygen and acetylene tanks on each side of the welding unit. This addition gave them a self-contained unit which provided for welding and cutting as well as electric welding—cutting their welding costs an appreciable amount, according to the story as reported by the Harnischfeger Corp., Milwaukee, Wis.

All of their welding is now handled by three hired operators, each with his own portable welder and personal car. These men take their machines wherever an outside welding job happens to be, and are paid on a mileage basis for hauling the welder. This scheme of operation not only has greatly reduced operating costs, but, more than that, it has resulted in a considerable reduction in original investment.

New Orders for Welded Stainless-Steel Cars

Recently more orders have been received by the Edward G. Budd Manufacturing Co. for light-weight stainless-steel passenger coaches, which are constructed by welding.

Among these is an order for 52 passenger cars from the Atchison, Topeka & Santa Fe Railroad. These cars which embody the newest designs in railroad passenger equipment, and will include 30 passenger coaches, 10 dining cars, 6 club lounges and 6 club baggage cars, is in addition to the de luxe 9-car train which the Budd company is now building for the Santa Fe in its Philadelphia shops.

An order was also received for 6 coaches from the Chicago, Burlington & Quincy Railroad. Four of these cars will be delivered to the Fort Worth & Denver City Railroad. Two of the coaches will be of the articulated type.

Educational Lecture Course on Structural Welding

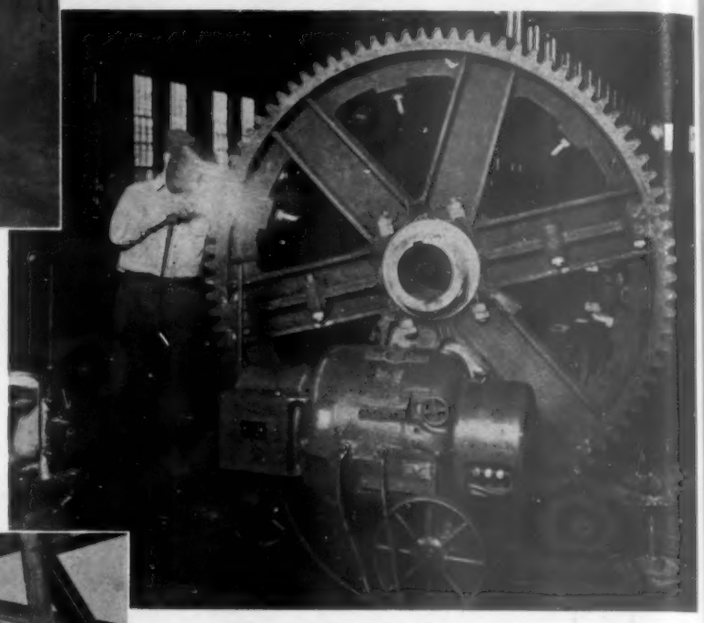
The Los Angeles Section of the American Welding Society is offering to engineers and designers of Southern California an educational course entitled "The Fundamentals of Structural Welding." The course will consist of some 12 or 15 weekly evening lectures ably presented by a group of local engineers and specialists. It will include the latest data on stress analyses, design methods, drawing details, specifications, qualification of welding operators and processes, fabrication and erection procedures, and the inspection of welded steel structures.

Practical instruction will be given each student, and physical tests will be made of specimens of work done. Strain measurements will be made on a welded rigid frame to determine residual stresses and show the effect of welding procedure upon frame distortion.

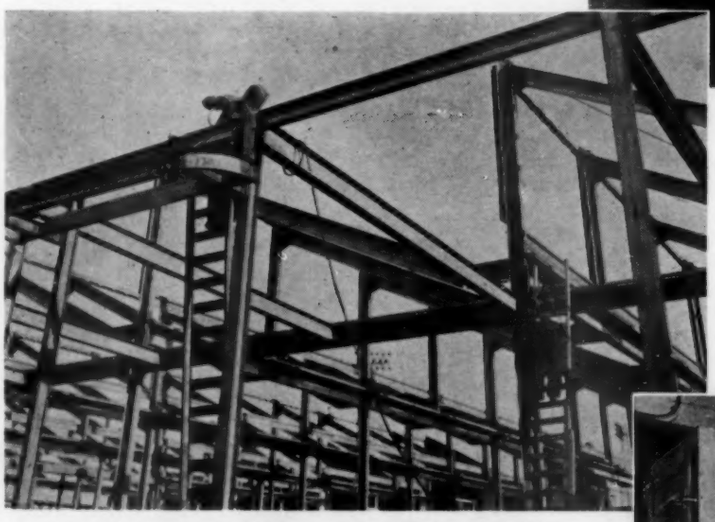
The price of the course is $15, which includes tuition fee and an associate grade membership in the American Welding Society. Tuition fee to present members, associate grade and others, is $5.

WELDING NEWS IN PICTURES

The locomotive design of this arc-welding unit attracts attention wherever it goes. It was built by Emil's Trade Auto Service, Queens Village, L. I., New York.

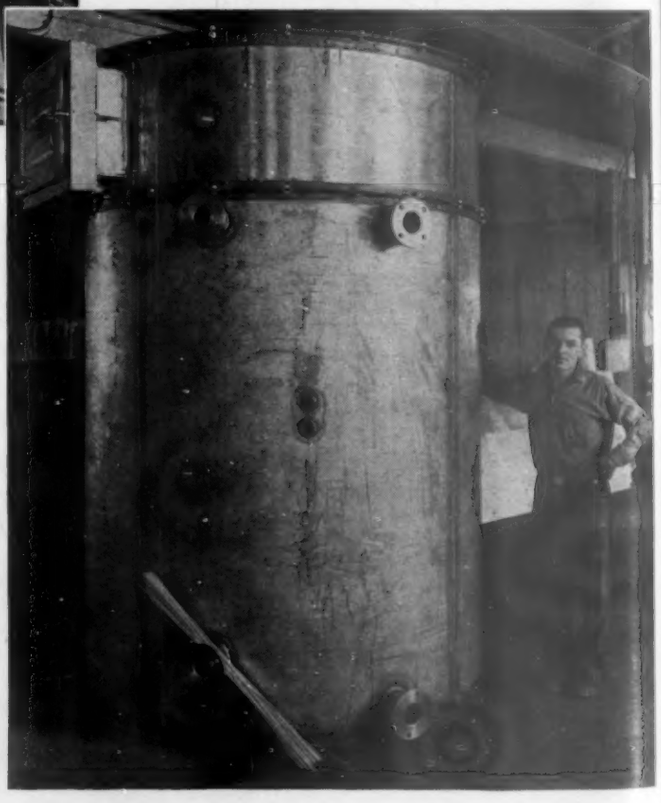


Dental work on a large gear, which is part of a 300-hp. slope hoist at the Loomis Colliery of the Glen Alden Coal Co. (Photograph by courtesy of the Westinghouse Electric & Mfg. Co.)



Streamlined design and construction are features of this 100-room building being erected at Middletown, Ohio, for The American Rolling Mill Co. It is supported by a welded frame. An unusual design of bent beam eliminates the necessity for multitudinous cross members.

(Below) This 1400-gallon welded Herculoy tank, fabricated by L. Koven & Brother for Carrier Corp., will serve the drinking water system of the Library of Congress Annex, Washington, D. C. The top section, containing the cooling coil, forms the cooling system.



Shell Oil Co.'s new 300-mile crude-oil pipeline under construction from Bakersfield to Martinez, Calif. Each joint was welded by the arc process. It was built at the world's record speed of 70 days. (Photograph courtesy of the Lincoln Electric Co.)

Metallurgical Problems *of Welding in the* Automobile Industry . . .

Paper read before the Detroit Section, American Welding Society, Feb. 12, 1937.

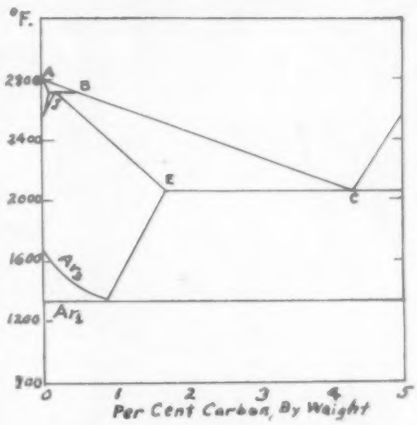
By DR. ARMAND DI GIULO
Metallurgist, Ford Motor Co.

THE public in general regards the developments of the last ten years of progress in the manufacture of cars as represented primarily by the radical changes in the outside appearance or shape, the greater safety in operation, as well as improvement in the performance of the power plant, specifically increased speed and greater economy. Yet, when one compares the present-day all-steel body with the body of 1927, for instance, one is actually considering two entirely different things. There is no doubt that the roomier all-steel bodies and the safer integral construction exemplified by the Lincoln-Zephyr could not have been built if welding had not permitted abandoning the composite wood-and-steel construction of yesterday.

The extensive use of welding in the Ford V-8 may be shown by the following figures: in a Tudor sedan, there are approximately 3,800 welds in the body and chassis, exclusive of the welds in component parts such as horns, generator, lamps, etc. Of all these welds, 92% are resistance spot weld, 3% arc welds, 2% oxyacetylene welds, and the remaining 3% is made up of resistance butt welds and seam welds. These figures, however, do not actually give a true comparison between the various welding processes because they are based on the number of welds and not on the inches of surface welded. However, to calculate the surface of all the welds in an automobile would be almost an impossible task.

Welding Makes Better and Lower-Cost Automobiles

The very wide application of welding has been dictated by sound engineering principles. First of all, welding joins parts into one whole, thus adding strength and eliminating rattle and wear. Second, welding reduces unnecessary weight. Third, the use of automatic welding machines has reduced or eliminated the human factor, and consistent, good welds can be obtained. Fourth, welding has materially reduced the cost of production.



Metastable Iron-Carbon Diagram.

For the sake of clarity, we may define welding as the process of uniting metals by means of heat and pressure or by heat alone in such a way that the resulting joint will develop strength and transmit stress. The common characteristic of all welding processes is that the metal is heated, and, with or without the aid of external pressure, the two metal surfaces cohere.

The various welding processes may be grouped in two classes:

Class A: those processes in which the metals are heated well above their melting point, and their union brought about in the liquid state;

Class B: those processes in which the metals are heated to the plastic state just below the melting point, at which time the application of pressure causes the union to take place.

Since the above classification differentiates between processes based on widely different principles, a more detailed subdivision of each class is necessary in order to describe the many welding processes used in the making of the present-day automobile.

Class A welding includes the following welding processes: (1) gas welding, (2) electric arc welding, (3) brazing, and (4) thermit welding. As has already been mentioned, in this class of welding the union is accomplished by heating the metals above their melting points. The difference between the processes is the source of heat, which may be supplied by: (a) the combustion of gaseous fuel, such as oxyacetylene mixtures, (b) the discharge of the electric arc, and (c) the exothermic reaction which takes place when aluminum powder and iron oxide (Fe_3O_4) are ignited.

Rapid Cooling From Welding Heat Changes Properties of Metals

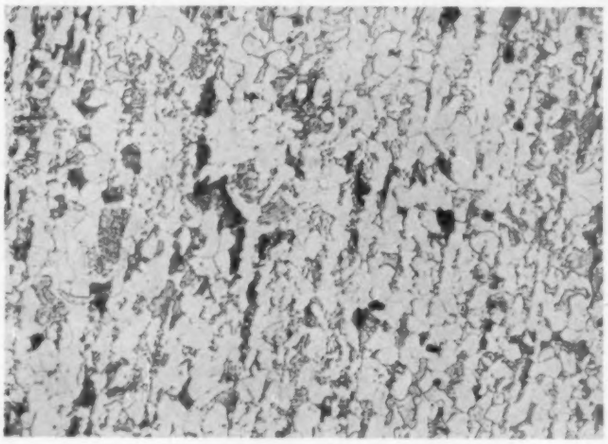
Without entering into a detailed description of each of these processes, we shall consider the metallurgical factors upon which depend the quality of the weld. The heating of the metals above their melting points, with subsequent cooling, results in a sequence of conditions in which the chemical and physical properties of the metals undergo marked changes. In the automobile industry, we are concerned mostly with the welding of steel; and in order to understand what takes place when two pieces of steel are welded, we must refer briefly to the metastable iron-carbon diagram.

Let us assume that the steel in question is a hypoeutectoid steel; that is, it contains less than 0.87% carbon. As we know, practically all the welds in the automobile are made with material of this type. If, for the sake of illustration, we consider a steel containing 0.4% carbon, the cycle of changes during welding might be summarized as follows:

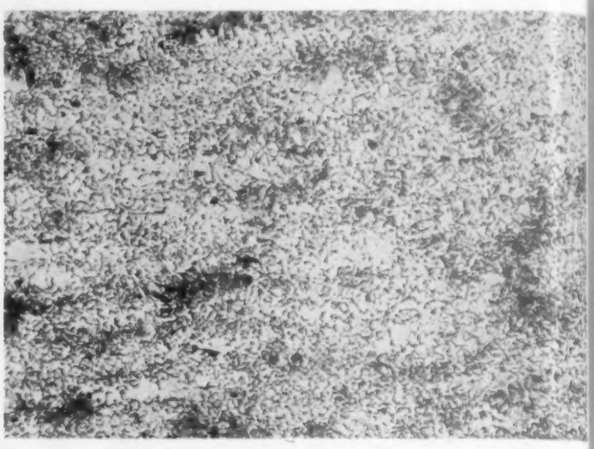
This steel, in the annealed condition, consists of ferrite and pearlite in about equal proportions; ferrite, or alpha iron, is the magnetic body-centered phase, pearlite is a eutectoid mixture of ferrite and cementite (carbide of iron). The carbon present in the steel is only slightly soluble in ferrite, and, at room temperature, is present in the cementite of the pearlite. As this steel is heated from room temperature, no phase change

PHOTOMICROGRAPHS OF ARC-WELDED FRONT RADIUS ROD TUBE (×500).

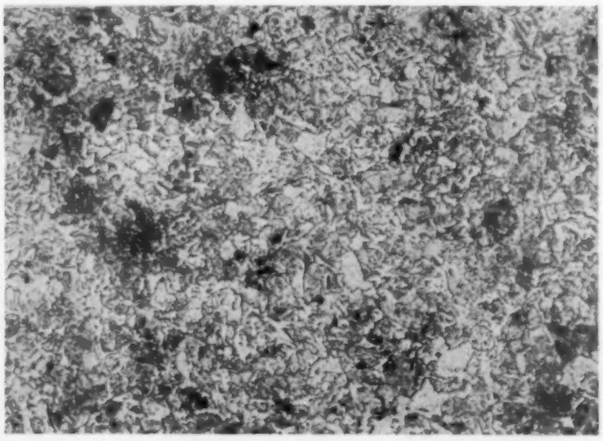
The tube is made from a steel flat of a composition similar to S. A. E. 1040 [C, 0.35-0.45; Mn, 0.60-0.90; S, 0.055 max.; P, 0.045 max.] and was welded in a continuous arc-welding machine at a speed of about 1 in. per second, using an electrode of the following composition: C, 0.10 max.; Mn, 0.20 max.; S, 0.02 max.; P, 0.03 max.



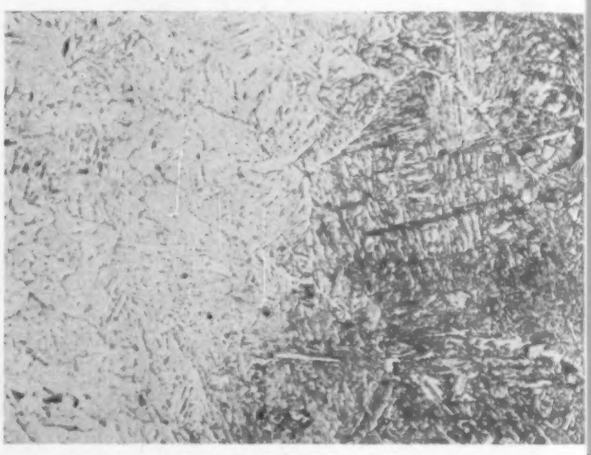
Typical structure of hot-rolled steel in the zone not affected by the welding heat.



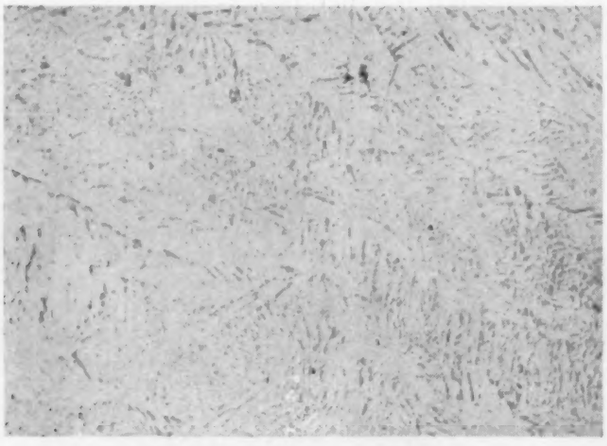
Structure of zone heated not much above the Ar_1 range, where recrystallization has taken place.



Structure of zone whose temperature was well within the austenitic range and whose large grains were produced on cooling from this high temperature.



Structure of the weld. At one side is the high-carbon steel of the plate, and at the other side the low-carbon steel of the electrode. The structure of the high-carbon steel indicates that the cooling was very fast, because the transformation from austenite to ferrite and pearlite has produced a very fine pearlite surrounded by ferrite. If the cooling had been slower, the temperature of transformation would not have been depressed, and the resulting pearlite would have had more of the appearance of the conventional plate-like structure, which is easily recognized even at low magnification.



Structure of electrode metal in the as-cast condition, as indicated by the large columnar crystals.

takes place until about 1335° F. is reached. At this point, which is the eutectoid temperature, pearlite becomes unstable and transforms into a new phase known as austenite, a face-centered cubic lattice. In this phase, carbon goes into solution to the extent represented by point E, corresponding to 1.7%. At this temperature, ferrite also begins to transform into the non-magnetic phase, and upon reaching the Ar_3 line, changes into austenite.

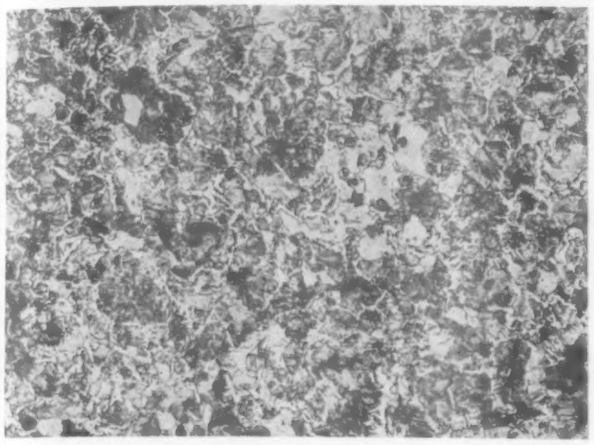
Further increase in temperature within the region of the austenite results in an increase in the grain size until the line J-E is reached, at which point melting begins. Within the area J-E and B-C, melting continues until a point on line J-B is reached, at which temperature (about 2,700° F.) the austenite decomposes into delta iron, plus liquid. Above line A-B-C the alloy is totally molten. Further increase in temperature above this point does not cause any change.

On the other hand, reactions between the metal and the slag, and between the metal and the gases present, take place primarily when the metal is in the molten state. These reactions are very similar to those which take place in the open-hearth furnace and are responsible for the chemical changes which occur both in the electrode and in the metal to be welded.

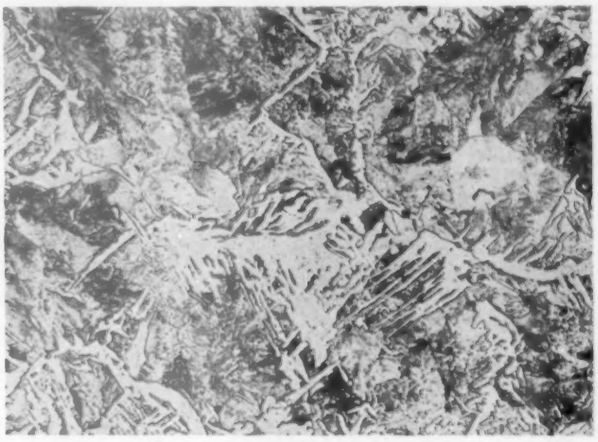
Numerous researches have established the fact that all the possible sources of heat used in fusion welding cause oxidation; therefore, care must be taken to minimize this effect. For instance, carbon may be oxidized to the extent of

PHOTOMICROGRAPHS OF BUTT-WELDED RADIUS-ROD FOQT (×500).

The forging is similar in composition to S. A. E. 1040 [C, 0.35-0.45; Mn, 0.60-0.90; S, 0.055 max.; P, 0.045 max.] and is resistance butt welded.



Structure of the forging, which is given a quench and draw treatment before being welded.



In comparing the structure of this weld with the arc weld of the front radius rod tube, shown on the opposite page, one notices that the grains in this case are well defined and much larger. It is evident that, although the temperature at this weld was never as high as in the previous one, the mass of metal heated was such that cooling took place much more slowly; thus, the transformation of austenite to ferrite and pearlite approached more nearly equilibrium conditions.

50% of the original amount in steels containing from 0.25% to 0.48% carbon. The amount of carbon "burned" depends primarily upon the type of electrode used and on the nature of the atmosphere surrounding the weld. Of the other elements present in steel, silicon is easily oxidized; next is manganese.

Nature of Electrode Has Bearing on Gas Content of Deposit

Besides these changes in the metals to be welded, the gas content of the deposited metal is also affected by the nature of the electrode; for example, a bare electrode deposits about 0.3% oxygen and about 0.12% nitrogen, while a shielded-arc electrode will deposit material containing about 0.06% oxygen, and 0.018% nitrogen. Of course, in the case of gas welding, the type of flame used will greatly determine the amount of gas left in the weld. In general, it may be said that stronger and sounder welds are produced with shielded electrodes.

Referring again to the iron-carbon diagram, when cooling begins, a reverse process from the one described takes place. The central portion of the weld, which has been heated above its melting point, will again transform at line A-B-C into delta iron, which reacts with any remaining liquid to form austenite; and when the temperature indicated by J-E is reached, the metal will be solid and completely in the austenitic state. During the solidification of the steel, a contraction in volume takes place accompanied by evolution of gases which were dissolved in the molten steel. It is during this period that gas bubbles and pipes are formed. At this high temperature some recrystallization takes place in the so-called "granulation zone." As the temperature is lowered, and as the Ar_3 line is reached, pro-eutectoid ferrite starts to form; this ferrite phase increases until the temperature of 1335° F. is reached, at which place the remaining austenite is totally transformed into pearlite.

At this point, however, we must consider the fact that in any fusion welding process, heating is accomplished at a very rapid and in a relatively small area; consequently, due to the thermal conductivity of the metal, there is present a temperature gradient which covers a zone extending from the melting point of steel at the weld to a point unaffected by the heating. On cooling, heat is dissipated from the central part of the weld at a faster rate than from the outer portions. It is within this uneven temperature zone that all the changes illustrated by the iron-carbon diagram take place at a very rapid rate. Equilibrium conditions are not reached; therefore, the structure of the weld and of the metal adjacent to it show practically all the stages of transformation for the steel involved.

As an example of what takes place, photomicrographs are shown of the parent metal and the weld of a Ford front radius rod.

There are other applications of arc welding which are very suitable for important parts of the car—for instance, the drive shaft. This consists of a tube, at either end of which is inserted a spline. The three pieces are welded together in a machine of the rotating type, using a bare electrode. Another application is found in the assembly of the rear-axle housing of commercial cars, in which case two forgings—a yoke and a flange—are welded to a seamless tube in an automatic revolving machine, the two welds being produced simultaneously.

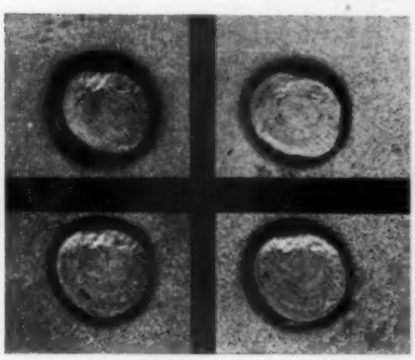
Gas welding finds only a limited number of applications in the production of the 1937 Ford. These are mostly in joints between the body proper and the floor panel, and in places where other welding machines could not possibly be used.

Class B, the pressure-resistance type of welding finds its greatest application in the automobile industry, as mentioned earlier in this paper. In this class, the parts to be united are brought to the plastic stage by the passage of electric current, heat being generated by the resistance offered by the metal. This heat is accompanied by the exertion of mechanical pressure, which helps to cause the union of the parts. It has been stated that the heavy localized heat and pressure cause re-crystallization of the metal, followed by grain growth, which permits the grains to grow together. This explanation seems plausible when one considers the fact that, in all resistance welding, mechanical pressure is applied; thus, the heavy localized pressure on a small area will provide the strain necessary for recrystallization.

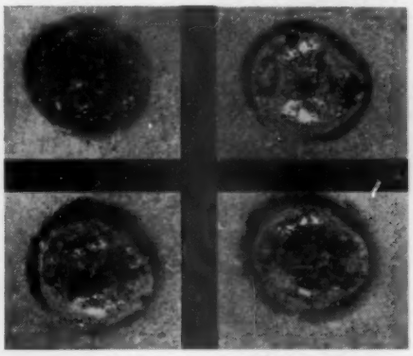
Automobile Manufacture Relies Largely on Resistance Welding

The resistance type of welding is by far the most important for the automobile industry because of its extensive application and the large capital invested. Its greatest advantages are: (1) a smoother finish, and (2) a quicker and more flexible method of fabrication of assemblies.

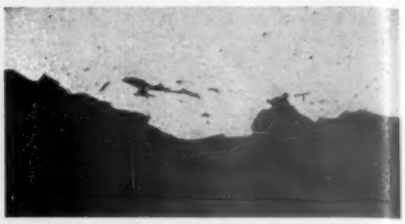
VIEWS OF SPOT WELDS, GOOD AND POOR.



Surface of spot welds made with new electrode.



Surface of spot welds made with "mushroomed" electrode.

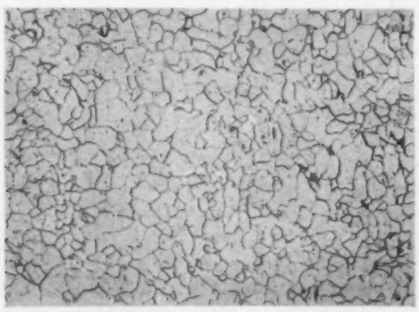


Cross-section (×100) of one of the welds shown at the left made with a "mushroomed" electrode. It is unetched, to show what seems to be a tear in the metal produced by the electrode tip sticking to the surface of the steel.

PHOTOMICROGRAPHS OF STRUCTURES OF GOOD AND BAD SPOT WELDS (×100).

Structure of a good spot weld. The equiaxed structure shown in the micrograph of the sheet steel below has disappeared and in its place there appears the coarse structure produced by the heat and the pressure of spot welding. The line of the weld is visible and at both sides of it one may see the extent of the zone in which the highest temperature was reached. For the average spherical-pointed electrode, this zone assumes the shape of an elongated ellipse whose major axis is parallel to the surface of the steel.

Structure at the weld of one of the spots made with a "mushroomed" electrode and shown at the top of this page. The heat and pressure were not uniformlly distributed; consequently, the recrystallized zone extends unevenly across both pieces of sheet steel. Such a structure is an indication of a poor weld—a fact that is further demonstrated by physical tests.



Typical structure of sheet steel (×100).

In the earlier days, most of the resistance welding was done by means of stationary hand-operated machines, but lately the tendency is, especially in the case of spot welding, to use the more flexible portable welders in which the welding is accomplished by hand-operated welding tools through which the pressure applied and the amount of current are automatically controlled.

The resistance-welding process is further subdivided into various categories, namely: (a) resistance butt welding, (b) projection welding, (c) seam welding, and (d) spot welding.

(a) *Resistance butt welding* consists in gripping the pieces between two electrodes or "jaws" and in pressing the parts together while the electric current causes heating at the surface of contact. The heat generated is high enough to bring the metal to a plastic state, and with the proper pressure very good welds are obtained. In some applications, the pressure is so regulated as to produce an arcing effect, which results in a flash weld.

Resistance butt welding finds only a limited number of applications in the making of the Ford V-8. However, it is used on such important parts as the front-radius-rod feet and the left and right members of the radius rod.

In the welding of the front radius rod, at the right and left end are welded two forgings, the so-called right and left foot. These forgings are given a quench and draw treatment before being welded. Both static and fatigue tests are performed daily to ascertain that the welds do not in any way impair the desired physical properties of the assembly. The structure of a weld of this type is shown.

In the welding of the right and left members of the radius rods, the two parts are united to the yoke, which is a steel forging similar in composition to S. A. E. 1030.*

(b) *Projection welding* takes its name from the fact that small projections are stamped on one or both pieces to be welded in order to localize the flow of current through the small areas. This process finds its application in cases where small parts are welded together or to a larger piece; also, it can be used successfully for thicknesses up to ¼ in. In the Ford passenger car, projection welding is used in various assemblies of the body, such as (1) the hood hinge bracket base welded to the retainer, (2) the head-light unit retainer welded to the front fender, and (3) the rear reinforcing assembly welded to the hood top.

*C, 0.25-0.35; Mn, 0.60-0.90; S, 0.055 max.; P, 0.045 max.

(c) In *seam welding,* the electrodes take the form of rolls, by means of which pressure is applied. Although this pressure is continuous, the current is regulated by means of an interrupter so that a series of overlapping welds is produced on the two sheets of steel. Seam welding may be considered as a continuous spot welding process in which each successive point of contact at the periphery of the rolls is the electrode. A typical application of seam welding is in the construction of the Ford gas tank, which consists of tern plate welded in a series of stationary machines.

(d) In *spot welding,* the pieces to be welded are placed between two electrodes whose tips are relatively small, and a large current of low voltage is passed through. Heavy pressure is applied at the electrodes and, immediately after, the current is passed for a short interval of time; the pressure being maintained momentarily after the current has been shut off. In modern automatic welding machines, elaborate timing devices permit close regulation of pressure and current, which assure welds of uniform quality. It would be almost impossible to enumerate all the parts of the 1937 Ford which are joined by means of spot welding, but, as I have already pointed out, spot welding constitutes by far the most used process of welding and its use is increasing continuously.

Choice of Electrode Material Is Important in Spot Welding

The chief metallurgical problem arising in connection with electric resistance welding is the choice of the proper electrode material. The quality of the weld, as well as the performance of the welding machine, depends primarily on the electrodes used. Briefly summarized, metals or alloys suitable for making resistance welding electrodes must possess the following properties: (1) high electrical conductivity, (2) high thermal conductivity, (3) a combination of hardness, impact and wear resistance, and (4) retention of these properties at the relatively high operating temperatures.

(1) *High electrical conductivity* is required in order to decrease the resistance and to prevent overheating at the point of contact between the work and the electrode.

(2) *High thermal conductivity* is necessary to keep the electrode tips as cold as possible by dissipating the heat generated during welding. In most spot-welding machines, water cooling is provided either by the use of hollow electrodes or by circulating water around them.

(3) *A combination of hardness, impact and wear resistance,* and (4) *retention of these properties,* are necessary because resistance welding in general, and primarily spot welding, makes use of relatively high pressures applied suddenly, and the electrode must be able to withstand such loads and transmit pressure to the work as uniformly as possible. It is necessary, therefore, that the area of contact between the electrodes and the work be constant. If the tip area becomes larger and uneven, the unit pressure becomes lower and a poor weld is obtained; also, considerable time is lost in redressing the electrodes.

Electrode Tip Must Be Smooth and of Uniform Area

One can hardly over-emphasize the fact that the electrode tip must be smooth and of uniform area to insure good welds. This point is better illustrated by the accompanying photographs of the surface of spots made with electrode tips kept in proper condition and tips that have been allowed to "mushroom." Photomicrographs of the welds are also shown.

The samples illustrated when subjected to tension gave the following results:

	Total Load to Break Weld	
Number	Good Welds	Poor Welds
1	1420 lb.	1265 lb.
2	1330 lb.	1130 lb.
3	1230 lb.	1125 lb.
4	1300 lb.	1190 lb.
Average	1320 lb.	1177 lb.

The requirements of electrode material are such that we are limited in our choice to non-ferrous metals and alloys. At the beginning of the development of welding in the automobile industry, forged or cold-rolled copper electrodes were used. Pure copper possesses the best electrical and thermal properties of any metal, but, in common with all other pure metals, it cannot be hardened except through cold-working. As is well known, properties imparted to metals by cold-working or straining disappear as the metal, through heating, passes from the strained to the unstrained condition.

High Operating Temperatures Require Use of Hard Alloys

The operating temperatures in almost all resistance-welding processes are such that copper electrodes are softened and become useless after a relatively short time. For this reason, and also because of the increased tendency toward higher working pressures, it became necessary to develop other alloys which could be satisfactorily substituted for the pure copper electrode. As a result, several alloys are now available whose electrical and thermal properties are not as high as those of pure copper but the other physical properties, especially hardness, are much better. Although their cost per pound is considerably higher, they have replaced copper electrodes almost completely because, in actual service, they are more economical because of their longer life. These alloys possess age-hardening properties; that is, they can be hardened by heat-treatment. However, even for these alloys, there exists a temperature at which they become soft; thus, care must be taken that, in service, this temperature is never approached.

In this connection, it is opportune to mention that the Ford Motor Co. has very successfully pioneered in the use of cast electrodes. These cast electrodes have proved to be as good as those made from bar stock, and the casting process has resulted in a considerable saving on account of the reduced amount of machining.

In conclusion, I would point out that welding has come to be a science instead of the haphazard art which it was not long ago. Metallurgy has played a very important role in its development. Further improvement will be brought about only by close cooperation of metallurgists, machine designers and users.

Program Announced for Iowa Welding Conference

The ninth annual welding conference to be held at Iowa State College, Ames, Iowa, on March 24 to 26, will consist of papers on welding subjects to be given on the afternoons of the first two days and the morning of the third day, with demonstrations occupying the remainder of the time, and a banquet on the evening of the second day. A feature of this year's conference will be round-table discussions at the close of each of the papers sessions. The following program has been announced:

WEDNESDAY, MARCH 24

8 a. m.—Registration, in Engineering Hall and Exhibit Hall.
9 a. m.—Exhibits and demonstrations.
1 p. m.—"Welding Copper and Copper Alloys," by W. C. Swift, American Brass Co.
"Repairing Heavy Cast-Iron Machinery," by F. C. Hutchinson, The Linde Air Products Co.
"Recent Developments in Machine Gas Cutting," by R. F. Helmcamp, Air Reduction Sales Co.
Welders Round Table, "Oxyacetylene Welding." Discussion leader, L. C. Monroe, "The Welding Engineer."
4 p. m.—Demonstrations.

THURSDAY, MARCH 25

9 a. m.—Demonstrations.
1 p. m.—"How Metals Change During Welding," by H. L. Daasch, Mechanical Engineering Department, Iowa State College.
"Past and Future of the Job Welding Shop," by J. M. Jardine, Western Welding & Boiler Repairing Co., Chicago.
"The Control of Expansion and Contraction by Local Heating in Cast-Iron Parts," by Roy Peterson, Peterson Laboratories, Emporia, Kan.
Welders Round Table, "Hard-Facing." Discussion leader, L. C. Monroe.
4 p. m.—Demonstrations.
6:30 p. m.—Welders' Banquet, direction of W. L. Allan, mayor of Ames.

FRIDAY, MARCH 26

9 a. m.—Motion Pictures, "Manufacture of Enduro Stainless Steel."
"Welding Stainless Steel," by F. R. Lichtenwalter, Republic Steel Corp.
"Modernizing With Welding," by W. M. B. Brady, General Electric Co.
Welders Round Table, "Arc Welding." Discussion leader, L. C. Monroe.
1 p. m.—Demonstrations.

All exhibits and demonstrations will be held in Exhibit Hall, and the papers sessions will be in Room 207, Engineering Hall. Further details can be obtained from D. C. Faber, Director, Engineering Extension Service, Iowa State College, Ames.

Penetration....

By BELA RONAY
Senior Welding Engineer, U. S. Naval Engineering Experiment Station, Baltimore

IN THIS article, the second in a series on welding fundamentals by Mr. Ronay, consideration is given to the meaning of the term "penetration" and the way is pointed out for combining good-penetration electrodes with low-energy-consuming electrodes to obtain economical welded joints. A simple experiment is described for comparing the penetration ratio of different electrodes. After performing the suitability best herein described, which can be done in any shop, the reader is asked to set down his observations and deductions and send them to Mr. Ronay or to The Welding Engineer. —Editor.

THE term "penetration" is not understood generally and therefore is constantly misused. In the handbooks on welding, its definition is given as "the depth of the crater." It is conceivable that this definition is responsible for the general misuse or misunderstanding of the term.

Had the above definition been accepted as correct, then penetration would be a one-dimensional quantity. The fact is that by the term penetration is meant the mass or volume of base metal remelted by a single bead or layer of the deposit. While the term penetration may be used in connection with any welding method, the following statements and remarks confined to arc welding may be helpful:

Penetration Pertains to Volume, Not Just Depth Alone

Being in a position to prove that penetration refers to mass or volume, it is evident that we cannot accept a definition which refers to one dimension only. It is elementary, that to determine the volume of a prism-like body we must have three dimensions. Therefore, in addition to the dimension of depth (the only one given in the handbooks), we must have width and length also. It is not believed necessary within the confines of this paper to give the details of the exact method for the determination of the penetration ratio of an electrode, but it does appear necessary to define the term "penetration ratio."

"Penetration ratio," in the glossary of welding terms collected and edited by the Subcommittee on Welding of the United States Navy Department, is defined as follows: "The ratio of the volume of base metal remelted by the deposition of a single electrode and the entire volume of the weld metal created by it."

A glance at the accompanying macrographs will clarify the meaning of the above definition. These macrographs refer to sections of the same thickness and are of approximately the same magnification. Therefore, it is evident that in spite of the fact that the depth of penetration is the same or almost the same in both sections, the ratio of remelted base metal to the total volume of weld metal is largest in the case of the "A" specimens. The "A" specimens were produced by depositing covered electrodes and the "B" specimens are sections of deposits made with sul-coated or so-called bare electrodes.

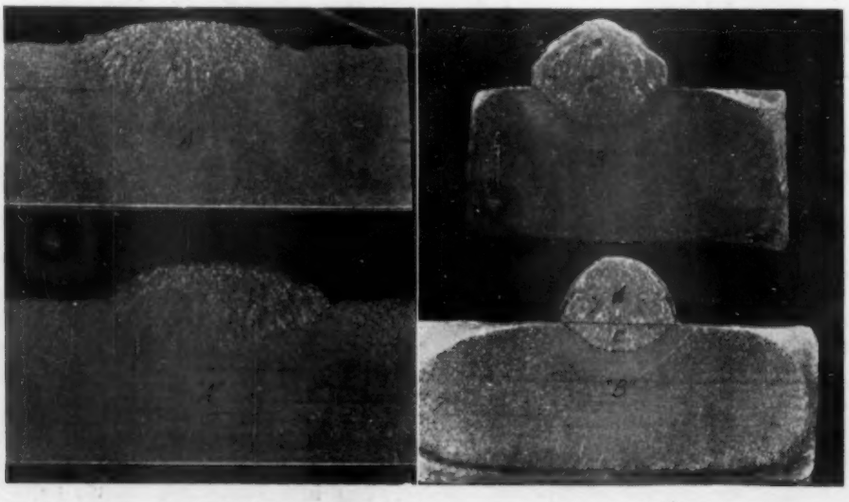
The matter of defining penetration may not be of profound interest to the practical welder or to the fabricator using welding as a means of production. However, the effects of penetration deserve much consideration, since they influence both workmanship and costs.

The penetration ratio of electrodes defines their usability and has a bearing on the cost of production.

Before going into these features, we must digress and review the matter of penetration briefly. Electrodes are referred to, by their makers, as having various degrees of, but usually excellent, penetration. As a matter of fact, penetration cannot be built into electrodes as a property, simply because penetration exists only under certain definite circumstances. It is like having a lap; rise, and your lap disappears. Similarly, it is possible to deposit any electrode without penetration, a fact known too well by those who have tried to weld copper without preheating. Taking several brands of electrodes of the same nominal size and depositing them to form beads of equal length, using the optimum current and arc potential for each, we find that various degrees of penetration are obtained.

Power Input Is Important Factor in Penetration

It has been established that the volume of base metal remelted is in proportion to the total power input required to deposit each electrode. Under normal circumstances the electrode requiring the maximum power input (in kilowatt-hours consumed and not the maximum kilowatt rate), is the one which shows the best (highest) penetration ratio—i. e., 50%. The prime factor influencing the penetration ratio, aside from the type and volume of the electrode covering, is the chemical composition of the electrode. The lower the carbon content, the higher is the melting point. Consequently, a greater power input is required to melt an electrode containing



Photomicrographs of Single-Bead Weld Deposits on Steel Plates of the Same Thickness.

(The two micrographs marked "A" were made with covered electrodes, and those marked "B," with so-called bare electrodes. Though the depth of penetration is practically the same in all four specimens, the ratio of remelted base metal to the total volume of weld metal is largest in the case of the "A" specimens. This ratio is determined by dividing the cross-section of deposited metal into two parts by drawing a horizontal line through the deposit indicating the original plate surface, as shown on the lower "B" specimen. Then the base metal melted is represented by c and the total deposit by $c+d$. The penetration ratio is therefore $c/(c+d)$.)

an 0.08%-carbon-bearing core than another with an 0.18%-carbon core. The power required to melt the lower-carbon-content electrode is about 13% to 15% over that sufficient to melt the higher-carbon electrode.

Penetration Is Influenced by Polarity of Electrode

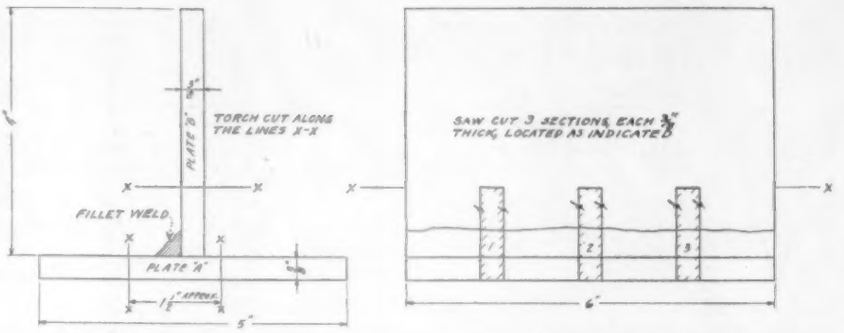
Another factor which influences the penetration ratio is the polarity used in the course of depositing the electrode. This, however, not an outstanding factor, because its influence diminishes rapidly with increasing plate temperature. It has practically no bearing on the rate of deposition.

Thus it appears that the electrode requiring the greatest power input for its nominal size is apt to show the best penetration ratio, and that the most desirable electrode is the most expensive one to use from the standpoint of current consumption. The average welding or fabricating shop cannot afford to investigate the claims made for all new electrodes offered for sale, because to determine the penetration ratio of an electrode requires making well-intensified macrographs, and for the exact determination of the weld areas a planimeter has to be used. Planimeters are instruments not found in welders' tool boxes. Moreover, even after having established the penetration ratio of several brands of electrodes, one is at a loss to determine which is acceptable, not having a standard of comparison to use as a gauge or rule. The question rises: Is it essential to use only electrodes capable of developing the highest penetration ratio in order to produce good welds consistently?

Those who purchase and those who fabricate highly stressed equipment know from experience that high-grade materials and workmanship must be used. However, there is competition and profits to think of and the engineer must stretch a point and offer, not substitutes, for there is no compromise with quality, but methods whereby satisfactory results may be obtained by the use of more economically performing electrodes.

Weaving of Electrode Increases Penetration

Since the penetration ratio is a function of the power input, it is possible to take the poorest performing electrode (from the point of view of the penetration ratio only) and deposit it in a manner capable of developing as high a penetration ratio as was found with the best-performing electrode. This can be done by weaving or oscillating the electrode to increase the current dwell or the power input for each unit volume of base metal covered with the deposit. Of course, the length of each increment or bead in this instance will be shorter.



Illustrating Preparation of Specimens for Comparison of Penetration Ratios.

Nor can this type of deposition be used in connection with thin-gauge metal, because the larger volume of metal deposited per unit length of seam or joint may cause melting through or may spoil the work through excessive warpage. However, there are occasions when this given method may be successfully and profitably employed, as in filling up a deep groove or building up a heavy fillet.

The penetration ratio is closely related to the weight of weld metal deposited in unit time. As mentioned above, the best (highest) penetration ratio is obtained from electrodes requiring the greatest power input for the longest period. Consequently, electrodes satisfying this requirement cannot head the list showing weight of metal deposited per hour. Thus it appears that the best electrode in regard to penetration ratio is the least economical to use.

Obtaining Economy by Using Both Low- and High-Input Electrodes

The prospective purchaser of electrodes must realize that the electrodes offered for sale vary not only in appearance but also in performance. There are electrodes having superior penetration characteristics and others of less desirable penetration ratio. It is evident, therefore, that no one type of electrode can answer all requirements and that the obviously intelligent solution is to use for the first layer, where wide weaving is impossible or impracticable, a type of electrode which is capable of developing good penetration with moderate weaving or when deposited in a single bead. The use of such an electrode in the places indicated is mandatory regardless of costs. The rest of the body of the weld, where wider oscillation or weaving is possible, should be filled in by using a faster electrode of a lower penetration ratio. Thus a good weld may be produced at a lower cost.

Method for Determining Relative Penetration Values of Electrodes

It is but natural that a short-cut method for determining the relative penetration ratio or penetration value of an electrode should be incorporated in this paper. A simple test recommended for this purpose is known as the "suitability test," the materials for which are shown in the accompanying diagrams.

It is important that the center portion of plate "A" shall be cleaned free of oil, grease, paint and rust, preferably by sandpapering it to a bright finish. The face of plate "B," which in the assembly rests on "A," shall be a machined surface to allow good faying with "A." The test consists of depositing *single-bead* fillet welds of such dimensions as are specified for the work on hand and using electrodes of the intended size at current rates which permit the most convenient handling.

Specimens Are Polished and Etched

Having marked the plates for identification and having recorded the current rates for each plate and electrode used, we next cut the plates along the planes x-x by means of an oxyacetylene torch, saw-cut the three sections as indicated on the sketch, file the faces of the sections smooth until all saw marks are removed, then polish, using in succession No. 1, 0, 00 and 000 emery paper until all scratch marks are removed and the faces show a mirror-like polish. Then etch the faces, using a saturated solution of ammonium persulphate. Try this procedure first, using a few brands or samples of electrodes in your shop, and remember that an unfused root is apt to cause failure of a fillet connection at normal working stresses.

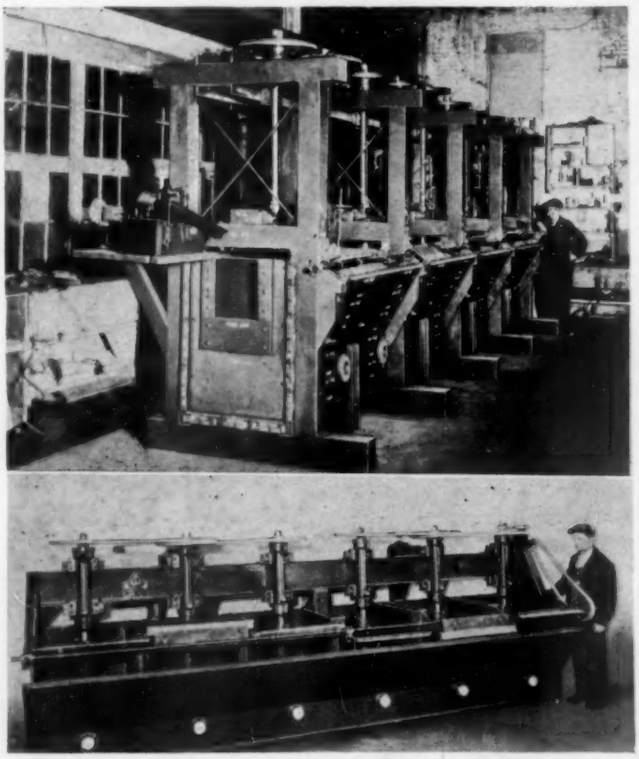
The above test does not yield any information on the rate of deposition. This matter was purposely omitted because its determination, while extremely simple, calls for the use of a laboratory-type exact scale and for an integrating electric clock, both items of equipment seldom available except in large laboratories. The statement that the excellence of penetration ratio is obtained at the expense of a lower rate of deposition is recommended to be accepted as obvious and true. Experiments performed with the use of unsuitable apparatus are apt to be misleading and may bring about false conclusions.

Economical Fabrication of
Ore-Treating Equipment . . .

By FRANK CONLY

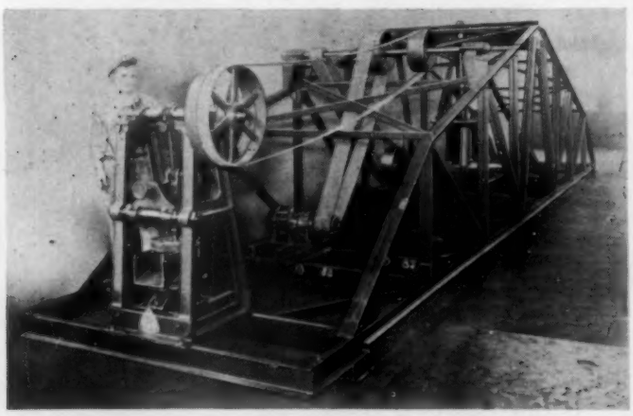
WELDING is playing an increasingly important part in the fabrication of equipment for recovering metals from their ores. This applies not only to the production of such precious metals as gold and silver, but also base-metal ores, including those using selective flotation, such as lead-zinc-iron ores, and copper-nickel ores.

The principle of flotation is basically simple. The ore is crushed to the required degree of fineness, then fed with

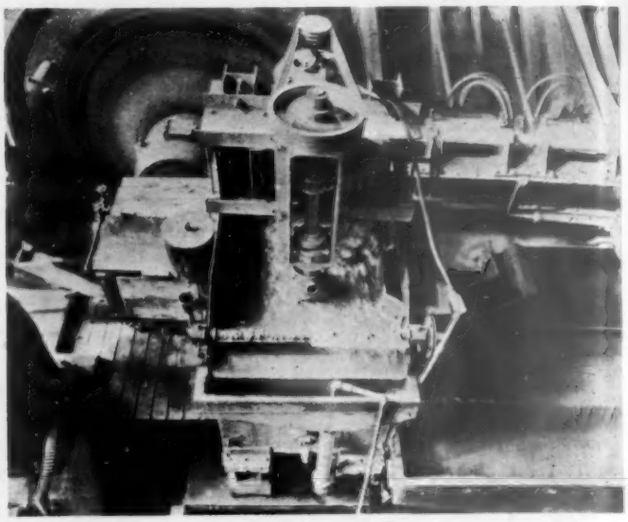


Comparison of Former High-Head Flotation Machine of Wood Construction (Top View) With Present Low-Head Welded Steel Machine (Bottom View).

(All-steel welded construction has made possible the development of the low-head machine of compact design, with resultant economy in cost and in shipping and reduction in space occupied. In this machine, the shaft assemblies are bolted to a steel beam mounted directly onto the steel tank. The cells, separated by steel partitions, are welded both inside and outside, giving a rugged self-contained unit, with a range of capacities up to 330 tons in 24 hours.)



Welded Superstructure for Thickener Tanks Up to 50 Ft. in Diameter.

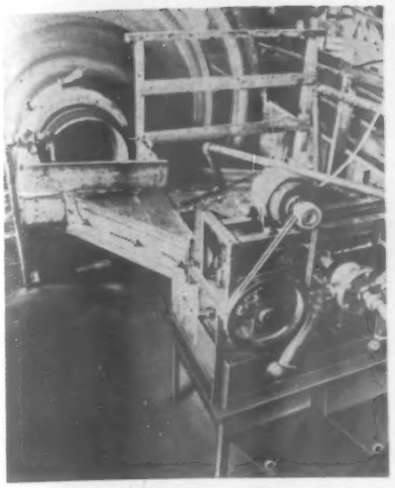


Welded Unit Flotation Cell.

(In operation between ball mill and classifier to recover values freed by grinding.)

Mechanical Pan of Welded Steel Construction for the Small-Scale Placer Miner.

(These machines have a set of three to five pans shackled to a frame. One or more are amalgamation pans, wherein the gold is recovered by combining with mercury. The others are steel pans with rubber matting to catch the gold escaping from the amalgamation pan. A gasoline engine pumps water by suction from the stream and also, through a ball-bearing eccentric, imparts a rocking vibratory motion to the pans, comparable with the most skillful hand manipulation of the old days. The pan area is 9 to 15 ft., depending on the number of pans in use, and the machine will handle all the gravel two men can shovel into the hopper. Besides placer gravel, this machine is used in recovering values from mine dumps and old mill tailings.)



All-Steel Mineral Jig of Welded Construction.

water to a flotation cell, where it is circulated with certain frothing agents. Air bubbles attach themselves to the particles of metal so that they are buoyed to the surface and discharged with the froth.

A raisin in effervescent liquid will demonstrate the principle. Bubbles attach themselves to the raisin so that it rises to the surface. As the bubbles break, it sinks to the bottom again—and this latter fact illustrates the importance of quick removal of mineral froth from a flotation machine, particularly when treating gold ores.

In selective flotation, the practice is to float off the different metals successively, the heaviest metal first, by the use of different reagents.

The Welded Machine Is Compact and Lower in Cost

Welding recommends itself not only for economy in construction and shipping, but also for economy of space, making it possible to reduce mill construction costs. Welded steel fabrication makes for compactness, as witness the photographs contrasting the former high-head wood construction with the low-head all-steel flotation machine.

A recent development in milling practice places a unit flotation cell between the ball mill and the classifier in order to save the bulk of the mineral values as soon as they are freed in the grinding circuit. Most ores liberate a large percentage of the mineral values during the first pass through the grinding unit, and there is an increase in total recovery when these liberated values are removed from the circuit at once, instead of being returned with the sands from the classifier, for regrinding.

The mineral jig is another device for recovering free mineral before it reaches the classifier. This jig consists of two compartments, and is of all-steel welded construction to minimize space required. Welding is also used in the construction of classifiers and the superstructures for thickener tanks.

Welding is proving economical in putting mechanical recovery from placer gravels at the disposal of prospectors and small individual operators.

Small-scale placer mining today presents a new picture as compared with the days of '49. Rich pockets are still occasionally discovered at bedrock, but much of the effort being put forth in this field is in the nature of working over ground already gone over, and recovering values originally lost. The average value of each cubic yard of gravel handled is lower than it used to be, even with the higher price for gold now prevailing, and more efficient equipment is called for.

Hydraulicking and dredging are still employed on large holdings, but these are for the capitalist. The man who once reached the "diggings" on foot, with his pick, shovel, hand pan, and provisions for the season packed on a burro, has been replaced to a large extent by the man with an automobile,

24-In. Clean-Up Pan, of Welded Construction.

who can easily move to a new location if his first choice proves disappointing.

Panning is still the most efficient method of recovery; but with lower values, a lot more yardage has to be handled in a day, if the placer miner is to recover day wages. The answer is the mechanical pan, which does all the work but the shoveling.

All-steel welded construction is used throughout in this machine, which must stand up against rough usage, so that the lone prospector may load it single-handed on a light trailer, unload and set it up at a chosen location; then quickly reload and go on, if he decides to seek new and richer ground. Next day he may again set up his machine 200 or even 500 miles away. Contrast that picture with the trudging pioneer beside his patiently plodding burro.

London Subways' Noise Problem Solved by Welding

By GEOFFREY BLACKALL

After many years of experiment, the problem of noise on the great underground railway system of London appears to be nearing solution. In the near future engineers of the London Passenger Transport Board will begin the task of welding together all rail sections—440 track miles, apart from projected extensions—and it is claimed that 60% of the noise now caused in the tunnels will be eliminated. The cost will be over £100,000 ($500,000).

The search for a remedy for the noisiness of subway trains has been carried on in London for more than 30 years. Attention was early directed to the ties and to the rails. None of the experiments with ties, however, proved very effective. The difficulty with the rails was that it was thought that the maximum length which could be handled in the tunnels was 42 ft., which means innumerable small gaps between the sections, and the wheels of the trains as they passed over these gaps contributed largely to the noise. When the Piccadilly line was extended to Cockfosters, rails 90 ft. in length instead of the standard 42 ft. were used. The noise reduction was so considerable that engineers turned to the problem of fitting continuous rails and handling 90-ft. lengths in the tunnels. A section of track on the Edware line was used for this purpose, and it was demonstrated that the 90-ft. rails could be used and that they could be welded together in position with a portable welding set.

There was also devised a special rail-grinding car to remove imperfections from the rails and to leave them absolutely smooth. On a measurement basis, this treatment left a tunnel 60% quieter than it was before.

An expert of the London Passenger Transport Board states that the engineers can weld together 270 ft. of rail and run these lengths into the tunnels on flat trucks. No trouble has been experienced with curves, and it is possible that the lengths may be further increased, so that 360 ft. can be dealt with in one operation. In Germany, on main lines, up to 2,700 ft. of rail has been run into position. The necessary machines have been ordered by the Board and rail-welding will shortly commence in London. The plan is to weld the maximum lengths possible in the workshops, and these lengths in turn will be welded together when in position in the tunnels. The work is expected to occupy a considerable time, owing to the shortness of the period during which maintenance and construction work can be carried out and to the big extension program the Board already has in hand.

Canada's Largest All-Welded Bridge . . .

By A. F. DAVIS
Vice-President, The Lincoln Electric Co.

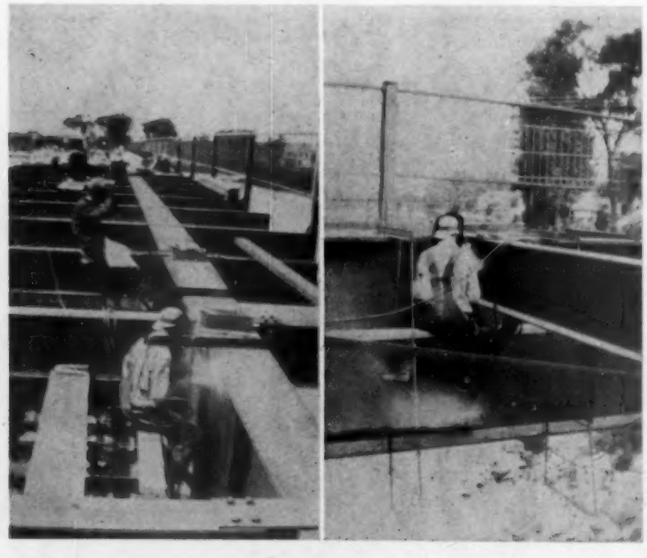
THE largest all-welded bridge ever built in Canada, and one of the first bridges to be erected entirely by welding on the North American continent, was recently completed across the Ste. Anne River at La Perade, Quebec, on King's Highway No. 2, main traffic artery between Montreal and Quebec.

This bridge is 642 ft. long with a 24-ft. roadway and 5-ft. sidewalk on each side. It consists of six continuous deck girder spans, each 107 ft. long. A design employing the minimum depth at the span centers and a pleasing arch form between the piers, was chosen as best meeting the two fundamental requirements — maximum possible water clearance to pass floods and a freedom from overhead obstructions to provide clear vision. The superstructure is supported on roller bearings on the piers to allow for adequate expansion and contraction under all weather conditions.

To facilitate the fabrication of the curved girders, tangent working lines were established for each span, and all floorbeams, stiffeners and splices were located normal to these lines, except the details located directly over the piers, which are vertical. Offsets from these lines established the profiles of the web plates, which were flame-cut to shape. The locations of all stiffeners and lengths of welds were marked on the web plates by means of stencils. The stiffeners were then welded to the plates, after which the webs were set upright and assembled with the top and bottom flange plates. Lugs previously tack welded at frequent intervals along the flange plates served to center the web plates for the assembling and tacking operations.

Continuous 5/16-in. fillet welds were used to join the web to the flange plates. Welding proceeded simultaneously from the center towards the ends and on both sides of the web plates. The welding operations were alternated between the top and bottom flanges to prevent distortion, which necessitated turning the sections over frequently by means of air hoists to permit all welding to be done downhand.

After all welding of details had been completed, the semi-finished girders were laid on trestles and aligned between two accurately spaced parallel heads. These heads served as guides from which lines parallel to, and a fixed distance from, the splices were scribed on the girder webs and flanges by means of a trammel. The ends of the flanges and web plates were then accurately flame cut and chipped to the proper welding bevels. All splice plates were located from the splice lines by means of jigs, and tack welded in position preparatory to final welding.



Welding the Girders and Floor Beams on 642-Ft. Bridge.

Girders Show High Degree of Accuracy in Alignment

The accuracy of the welding fabrication was shown when adjoining girder sections were shop assembled and the main working line found to be less than 1/16 in. off at the splice. Only sufficient splice material and connection details were provided to insure proper assembly of the component parts in the field and to take care of the erection stresses.

The spans were erected by means of a traveller running on temporary timbers

laid across the floor beams. Pile bents were driven where necessary to support the outer ends of the girders, and the main splices were brought together by drift pins and held by turned bolts to obtain accurately matched joints.

Field welding was delayed until after four spans had been completely assembled and the fences plumbed. The type of structure and the location of the welds were ideal from the welders' standpoint. The details were designed so that all the welding was downhand or vertical and readily accessible, and none of it was overhead work.

Light welded frames suspended from the floorbeams served to support scaffolds from which the girder web and bottom flange could be reached. These frames were ladder-like in form to accommodate the scaffolding at different levels, and were light enough to be moved about by one man.

Four 300-ampere welding units were used for the work and eight operators were employed for approximately four weeks working in double shifts of nine hours each.

Splice Plates Were Removed or Edges Cut Away

After the splice welds had been completed, the outstanding edges of the splice plates were burned off, and the bottom flange splice plates were removed entirely, by chipping out the weld metal connecting them to the flanges. All bolts were removed from the web splice plates, and the holes were filled with plugs, welded in place, and chipped flush for appearance.

The total weight of structural steel in the bridge amounted to 318 tons, of which 183 tons represents the main girders. The amount of shielded-arc electrodes used was 6,460 lb. in the shop and 1,780 lb. in the field.

The superstructure was fabricated and erected by the Dominion Bridge Co., Ltd., of Lachine, Quebec, who were also the general contractors for the entire work. The work was supervised by L. F. Gaboury, on behalf of the parish of Ste. Anne de la Perade and the village of La Perade, who are the joint owners of the bridge.

Designs for simple girder spans and for riveted continuous spans were also investigated. The estimated weight of the continuous welded girders was 85% of the simple-span welded girders and also 85% of the continuous riveted girders, so that the adopted design showed an apparent saving in weight of about 27% as compared to simple-span riveted girders. Additional savings resulted from the elimination of duplication of pier members, floorbeams, fence posts and floor expansion joints over the piers.

Woman Welder Says Her Sex Is Discriminated Against

Woman's lot as a welder is not a happy one, because of prejudice shown against her by the opposite sex, says Mrs. Elizabeth A. Levonas, of Towson, Md., in commenting on the article "Mother of Four Likes Welding Business," which appeared on page 40 in the February issue of *The Welding Engineer*. The handicaps and disappointments she has experienced in an effort to stay in the welding field are related by Mrs. Levonas as follows:

In 1918 I went to work in a railroad shop as a welder, during the war when men were scarce, and the company was glad to get women then. We had to serve four years as an apprentice before they would consider you as a welder, the same as all the different crafts.

All welders had a tough fight on their hands, and especially the women. The other crafts were antagonistic to welders; they said we were taking their work away from them. As soon as the foreman would put a woman on a firebox, to weld side seams or a flue sheet on a boiler, the boilermakers would go to the superintendent and complain. If a woman welded it they thought it wouldn't hold pressure.

We not only had the other crafts to buck, but the welders were jealous of the women as well and did everything in their power to make life miserable for us. They wouldn't teach us anything unless they were compelled to. Some of the things they did were exasperating and amusing, though not at the time. When we would get an important job or be working piece work, they would hook up on our panel, at another end of the shop, and ground it so we couldn't work. If we were working on an overhead job, they would shove a bucket at our feet to catch the metal. And if I was working on a frame with another welder, he would send me for his welding rods or to change the heat on his panel for him, so I wouldn't get ahead of him—and, naturally, because I was just a kid and he was old, I would do it.

But still I stayed in the fight for 14 years and enjoyed it. I always found electric welding both fascinating and interesting, and I was determined to stick to the bitter end and be as good a welder as I possibly could. Then came the depression. I was unable to hold on any longer; the men wanted my job; in 1932 I was furloughed indefinitely.

Last summer I had an offer from a Cleveland firm to demonstrate electric welding machines at the Metal Congress held in Cleveland during October. Naturally, I wanted a little practice to make sure of myself. I knew it was hopeless to ask at my former place of employment, so I resorted to the next best thing. I picked a welding and repair shop that had just run an ad for welders. I stated my case, volunteered my services, without pay, and assured the proprietor he was taking no risks. One day's work would have satisfied me, for all I needed was the feel of the clamp in my hand to give me that old self-confidence. The owner himself was enthused, for he was thinking of the publicity a woman welder would give him. But he naively said that he would have to ask the "boys" if they would consent to having a woman work with them. That was as far as it went. I never heard any more about it.

So only having actual experience, I decided to go technical. I went to the library and got all the good books I could find on welding. I lived, studied, and dreamed nothing but welding for months and looked forward to being at that show. But the crowning blow was yet to come. About two weeks before the show, the company informed me that they regretted to have to change their plans, and they couldn't use me as a demonstrator. The idea was too modern, and they were afraid the men would think they were suggesting women welders.

In the meantime, a friend was in the market for a welding machine. He had confidence in my ability as a welder and asked me to attend to the buying of a machine for him. When I went to the show room to inquire about the machine, the manager himself snickered in my face, and presented an indifferent attitude, as much as to say, "Why waste my breath and great knowledge on the female brain, for she would be unable to comprehend and absorb it?" If he only but knew how he was mistaken and lost a sale! He went so far as to suggest that I look at one of the small welders on the market, because they were cheap. He didn't know what I could afford, but he couldn't be bothered. When a man sells cosmetics, women don't question his right in that field, if he knows his business. So, why do men use so much discrimination?

As a final word, I would say that any woman who has reached the top as an electric arc welder deserves a medal for all the obstacles she has overcome in gaining it.

A.S.M.E. Meeting Will Have Papers on Welding

Methods of fabrication, including welding, will come in for discussion at the semi-annual meeting of the American Society of Mechanical Engineers, to be held at Detroit, May 17 to 21, with headquarters at the Statler Hotel.

Among the many excellent papers scheduled for this meeting is one on Tuesday evening, May 18, by William S. Knudsen, executive vice-president, General Motors Corp., on "Recent Developments in the Basic Processes of Fabrication," in which he will consider the social and economic implications of casting, forging, welding, machining, pressing and rolling.

A welding session will be held on Wednesday afternoon, May 19, with a paper on "Welded Fabrication of Large Frames," by Everett Chapman, president, Lukenweld, Inc., and one on "Hydromatic Welding of Frames," by C. L. Eksergian, chief engineer, Budd Wheel Co.

Dye-Machine Tank Repaired by Welding

A break in a 50-gallon dye-machine tank caused by failure to withstand steam pressure has been welded and the tank relined with ⅛-in. monel metal for the Johnson City Mills, Carnegie, Johnson City, Tenn., hosiery manufacturers, by the Southern Welding Co., of the same city.

Shop Turns Out "New Deal" Angleometers

Swift "New Deal" legislation nowadays keeps shops with Government contracts on the jump. Here's a case where one welding-shop owner filled a rush order on a machine that had never before been designed or constructed.

O. H. Robey, general manager of the Robey Manufacturing Co., East Lansing, Mich., received an order for 5,000 Angleometers, 1,500 of which were to be delivered in one week. The Angleometer is a device for measuring farms for the Michigan State Conservation Bureau, an outgrowth of the A.A.A. The Bureau was to determine the acreage of every farm in the state. All data obtained were to be used as a check on farmers who have received compensation from the Federal Farm Bureau for not plant-

Spokes Arranged in a Jig.

Operating the "Angleometer."

ing a given acreage, as outlined by that Bureau.

Mr. Robey and a representative of the Wilson Welder & Metals Co. together laid out a procedure for the construction of the Angleometer. They both realized that the manufacturing problem was one of economy and speed, and promptly decided on arc-welding, using a 200-ampere machine. All fixtures and strips composing the measuring machine were joined by this method with perfect results and the wheels were furnished in the allotted time.

The materials needed and complete specifications for the construction of the wheel are available for any one faced with a similar job. Soon every state in the Union will be compelled by the Farm Board to measure its farmlands in the same manner, and the plans should prove to be useful to welding-shop owners and contractors.

Chart for Finding Allowable Loads on Welded Joints

By R. J. HOFFMAN

The accompanying alignment chart readily gives the estimated safe loads on arc-welded joints without having to make tedious calculations. It is constructed on the basis of accepted stresses of 13,000 lb. per sq. in. for tension, 15,000 lb. per sq. in. for compression, and 11,300 lb. per sq. in. for shear, all loads acting through the center of gravity of the section; eccentricity would increase the stresses beyond the uniformly distributed stresses assumed.

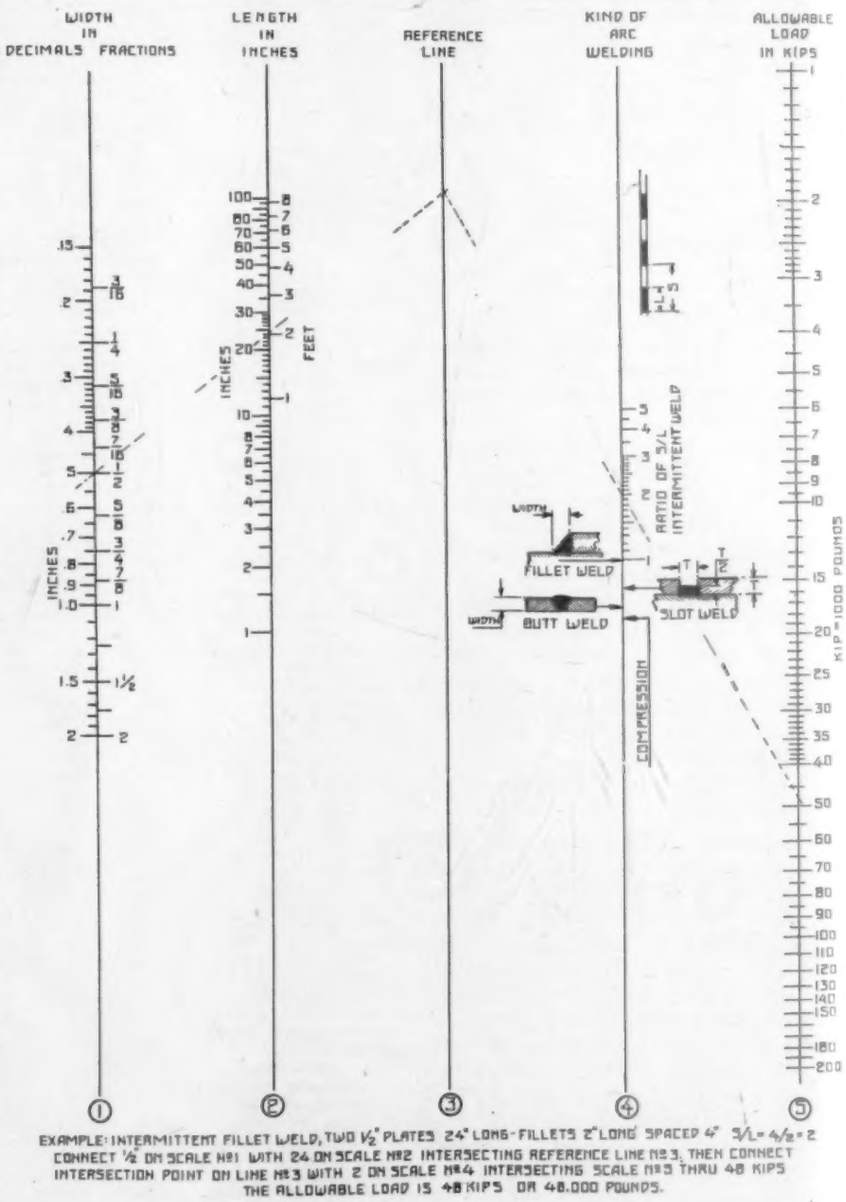
For shear calculations, the cross-sectional area is to be taken through the throat of the fillet weld; this inconvenience to the estimator is eliminated by assuming that the fillet weld has always the form of an isosceles triangle of 45° and that the throat dimension is replaced by the leg dimension, thereby reducing the allowable stress to 8,000 lb. per sq. in. for the area of the fused surface—usually the length of the weld times the plate thickness.

The chart estimates the allowable loads on arc-welded connections for fillet welds, intermittent fillet welds, butt welds, and slot welds.

For convenience, the chart is appended with a specific example, for which the lines are marked on the scales. In order to preserve the chart it is only necessary to lay a straight edge across the scales and place a pencil point at the intersection of the two lines on the reference line.

This chart can be used if any three factors are known and the fourth one to be found. Though the example given at the foot of the chart has to do with determining the allowable load, the chart can also be used for other calculations.

For example, to find the length of the weld necessary which will hold a certain load, if the width and the kind of weld to be used is known, we connect the values on scale No. 5 and scale No. 4, intersecting the reference line; then we connect the intersection point with the width on scale No. 1 and find the length required on scale No. 2. Other problems like the finding of the spacing of intermittent welds if the length, the thickness and the load are given, are also easily solved.


WIDTH IN DECIMALS FRACTIONS
LENGTH IN INCHES
REFERENCE LINE
KIND OF ARC WELDING
ALLOWABLE LOAD IN KIPS
INCHES
FEET
RATIO OF S/L INTERMITTENT WELD
FILLET WELD
BUTT WELD
SLOT WELD
COMPRESSION
KIP = 1000 POUNDS
EXAMPLE: INTERMITTENT FILLET WELD, TWO ½" PLATES 24" LONG - FILLETS 2" LONG SPACED 4" S/L = 4/2 = 2
CONNECT ½ ON SCALE NO 1 WITH 24 ON SCALE NO 2 INTERSECTING REFERENCE LINE NO 3, THEN CONNECT
INTERSECTION POINT ON LINE NO 3 WITH 2 ON SCALE NO 4 INTERSECTING SCALE NO 5 THRU 48 KIPS
THE ALLOWABLE LOAD IS 48 KIPS OR 48,000 POUNDS.

16 Manufacturers Exhibit at Ohio Conference

Sixteen manufacturers and distributors of welding and cutting equipment and supplies had exhibits and demon-

strations at the Ohio State University welding conference held at Columbus, O., on March 4 and 5. The Industrial Commission of Ohio also had an exhibit.

The conference had a total registration of 716, approximately 200 of which were students, and the arc-welding school, conducted for three days, had an enrollment of 143, of which 24 were state bridge engineers and 73 were from the students and faculty.

The only change in the papers program as announced in *The Welding Engineer* was the substitution of a paper by Leon C. Bibber, of the U. S. Steel Corp., for one by A. E. Gibson, who is sojourning in the South on an enforced vacation to recover his health, following an appendicitis operation.

High Steel Prices Stimulate Welding Activity

By EDWARD H. SYKES

Pittsburgh Correspondent, *The Welding Engineer*

The sudden recognition of the Committee for Industrial Organization, by the Carnegie-Illinois Steel Corp., of Pittsburgh, giant U. S. Steel Corp. subsidiary, and the subsequent increase in prices of steel plates and shapes, is having a very confusing effect on the welding trade. Barge builders, for example, and other fabricators of welded steel equipment who are bidding on equipment or have bids out, do not know from one minute to the next just how they stand on quotations.

At present, the steel plants in the Pittsburgh district are operating at better than 86% of capacity in the face of recent extensions that have added considerably to the old capacity figures. The activity is so pronounced and orders are being received in such volume, that some of the companies have become selective and have been forced to accept only special types of orders.

The large barge shops in the Pittsburgh district, and there are about half a dozen of them, are obtaining steel, but at this time deliveries are coming through only after much prodding and usually four to six weeks after the placement of orders. However, a rising market and a back-ordered market are usually good omens, and all the industrial leaders in the Pittsburgh district are optimistic regarding the immediate business outlook.

Another pleasant phase of the steel corporation's action in recognizing the C. I. O. is the belief, which exists among many, that the possibilities of strikes and labor troubles in the steel industry have at least been temporarily set aside.

One noticeable effect of the increased steel operations is the heavy demand for welding equipment of all kinds. In addition, all the welding shops in the "Steel City" are unusually busy as a result of the great activity in steel.

Adopts Welding for Ladders and Other Types of Frames

By DWIGHT ABBOTT

The enormous expansion in the use of welding in building construction is well illustrated by the work being done by the J. B. Klein Iron & Foundry Co., of Oklahoma City, Okla.

From having, a few years ago, done a considerable amount of its structural business on cotton-seed-oil tanks, the company now finds its greatest source of business in the building trades industry, Mr. Klein reports.

The extent to which its building business has grown is indicated by the fact that the plant is now using welding in almost every "joint" of the goods turned out. Fire escapes, balustrades, ladders, window guards and a vast amount of metal ornamental work is now almost completely welded.

It was but a few years ago, Mr. Klein recalled, that steps in metal ladders, for instance, were pronged through the iron uprights and bent over to secure them, leaving them comparatively loose in the frame. Likewise riveting was used throughout in the construction of heavier structural pieces.

Riveting has been replaced by the weld, which makes a continuous, solid unit of the article. Column bases and caps, once riveted, are now welded; only on some of the bridge work done by the firm is riveting still used.

Another item for which the Klein plant is well known is its fence, where welding finds heavy use in the construction of gates and supports. The business in fence wire, greatly stimulated by the necessity of fencing wells being drilled inside the limits of Oklahoma City, represents about 8% of the business done, Mr. Klein said.

Recent building activities have sent production of the plant up approximately 30% over the same period of a year ago.

School and Conference on Strength of Materials

A special Summer School and Conference on Strength of Materials will be held at the Massachusetts Institute of Technology for four weeks beginning June 21. The subject of "Creep" will be presented by Dr. A. Nadai, with the last two lectures by C. R. Soderberg, both of the Westinghouse Electric & Manufacturing Co. Design applications using the plasticity theory will be discussed by Mr. Soderberg. The lectures on "Fatigue" will be given by an outstanding authority on this subject—Dr. H. J. Gough, of the National Physical Laboratory, England. The lectures on "Strength of Materials" will be given by the Institute's own staff, the laboratory exercises making use of the more modern measuring instruments and apparatus. Further particulars may be had from John M. Lessells, Department of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, Mass.

News of Welded Pipelines

The Northern Natural Gas Co., Omaha, Nebr., recently let a contract for approximately 20 miles of 20-in. pipeline running from Clifton to Washington, Kansas. Truman-Smith Construction Company, Eldorado, Kansas, was the successful bidder. The welding will be done by the electric arc process.

The Continental Oil Co. has just let a contract for 37 miles of 8-in. oil line to the Osage Construction Co. The line runs west from Geneseo, Kan., and will be oxyacetylene welded, according to a report from The Linde Air Products Co., New York.

The White Eagle Oil Co. plans to lay a 43-mile 10-in. welded loop oil line to parallel its present system from Valley Center, Kan., to a point near Hollow, in Harvey County.

The arc-welding of 32 miles of 8-in. line for the Gulf Oil Corp. near Carthage, Texas, has been completed by H. C. Price, Inc., Bartlesville, Okla. The Latex Construction Co., of Houston, Texas, were the general contractors.

The Truman-Smith Construction Co., Eldorado, Kan., are well under way on the laying of the 10-in. oil line for the White Eagle Division of the Socony-Vacuum Oil Co. The loop extends from the Valley Center, Kan., oil pool to the Hollow pool in Harvey County.

A contract for the arc welding of 59 miles of 8-in. pipeline in Kansas for the Phillips Petroleum Co. has been received by H. C. Price, Inc., Bartlesville, Okla., from J. F. Pritchard & Co., of Kansas City, Mo.

The DD Oil Co., of Mission, Tex., will soon construct a 125-mile welded oil line from the oil fields of Starr and Hidalgo Counties to the deepwater ports of Brownsville and Port Isabel.

Get "H. O. T." on Welding

By H. O. T. RIDLON

The Answer

In this sheet for January, just above my line of chatter—or outburst, as Hank Booth called it—(yeah, I read my own stuff, too) was a swell little poem by Clarence E. Flynn. Here are the answers to his questions.

You'd like to know that secret
For which the whole world gropes
You'd like to know the methods
For welding broken hopes—
Of welding broken hearts—
For welding broken dreams!

Youth is the secret of all hopes,
Live young—keep hopes high—and
They'll never need welding!

If your heart is really stout
As it should be, Son,
It will never really break!

Stick to your dreams, hold them fast!
Because it's dreams that makes
This grand old world of ours.
And that will never break,
Nor will your dreams—if you hold them fast!

• • •

Did It Ever Happen to You?

The other day Johnny Johnson went back to his rooming house to get cleaned up after his Saturday night beans. He'd been doing a lot of arc welding that day. It was one of his first full days on the arc. While he was cleaning his teeth he discovered that his tongue was black. He almost got the big jitters. Hurried down stairs to 'phone me to know what had happened to him. But first he asked his landlady if his tongue looked black to her. It did. Promptly the big jitters set in. My 'phone was busy. And while he was trying to reach me his landlady found out that he had had blackberry pie for dinner, and the big jitters passed as quickly as they had arrived.

• • •

It Won't be Long Now

Yes, sir, 'tis a fact that the good old springtime will soon be with us. And many shops will be getting trailer orders—big and little ones. And trailers must have some kind of a hitch. And what hitches you see as you go about the country!

There's a gent in my town—Mansfield, Ohio—by the name of Watson that makes a really good one. It fits into a 2-in. pipe and has more than enough strength built into it to handle most any load you'll want to hitch on. The 1¾-in. ball is turned, complete with its threaded pin, from a solid piece of steel. Here's a couple of pictures of it.

This same gent Watson has built up a smart all-welded trailer axle that he sells. It's a durn smart job, giving lots of strength with light weight. As you can see from the picture he uses a Shelby seamless tubing, plates cut to shape and the balance standard Ford parts. It really is a grand job.

• • •

A Money Making Idea

My good friend, H. R. Whetstine, sends a drawing from Arkansas City, Kan., with comments. He says, "A road contractor or city can save plenty of money by using this idea, as the hub is very seldom worn out but the rim is. The studs are to be as wide and thick as the old spokes. Welded all around. This makes a good job for any shop. We used to get $50.00 for a rim from a steam tractor—just for welding and lining up. A person can finish one in eight hours. I've welded at least two dozen in and around San Antonio, Tex., and all are successful." There you are my friends. Perhaps you can knock yourself out some pretty nice jobs for yourselves with that idea.

Method of Welding on New Wheel Rim.

• • •

And the Old World Grinds On

Months ago I asked for expressions from you shop owners regarding what you thought about grinders. Well a lot of you guys answered me either in person or by mail, and each expression was truly appreciated. After summing up and digesting all you'd said and written about this important subject I found that it was an even bet for the flexible-shaft grinder or the hand grinder. So I started looking about for myself.

I wanted strength, speed, light weight, balance, and if possible one I could fix up on a stand of some kind and use as a bench grinder. And believe you me, I did some looking, and believe it or not it was right along, as you might say, within easy reach for me. The Stoody Co. has just what I was looking for. I'd always known these gents know how to make swell hard-surfacing rods, but it never occurred to me that they'd also know how to make a grinder that would fit perfectly into a job shop.

I understand from Dan Staley, sales manager of this company, that they really are not in the grinder-manufacturing business, but look into a Stoody catalog to get the "specks" on this grinder when you're in the market for another one. It's really the nerts.

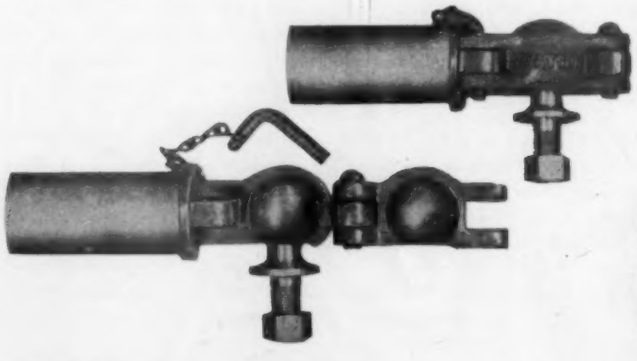
• • •

Do YOU Know That—

A smartly gotten up hand-bill, telling the services you can render the people briefly in large clear type with simple words is a great business getter when passed out from house to house, or car to car? On a Saturday afternoon or evening it is not hard to get your story over to many hundred people by getting down town and putting them in cars. You'll find a decided pick up in business if you do this for a few weeks.

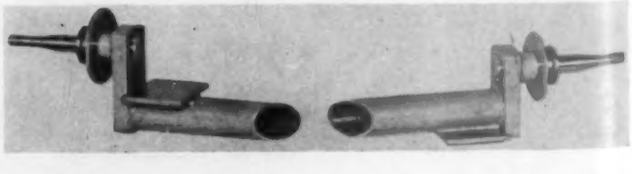
Now is the time to get out and sell Mr. Farmer the idea of letting you hard-surface those plow shares? You can take them into the shop with you and they'll be all ready for him whenever he wants them.

In a month or so from now contractors will start getting their equipment



Left—Trailer Hitch in Open and Closed Positions.

Below—Welded Trailer Axle, Made From Seamless Tubing, Plates and Ford Parts.



in shape for the summer's business? And that there are lots of hard-surfacing jobs you can sell to Mr. Contractor this Spring? Start talking to him NOW!

A really good and outstanding sign, well painted by a sign painter, pays for itself many times over each month?

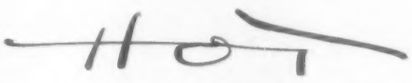
• • •

"Time Flies," or Something

The other day Harris Goodwin—affectionately known as Goodie—started to introduce a speaker at a dinner in Chicago, when the speaker of the evening was only half through his dinner. Most naturally the speaker started to hurry. Someone noticed it, and yelled to him, "Don't hurry, Mac, take your time; you'll be through long before Goodie finishes!" He did, and was.

• • •

The thought for the month: Live for today. Yesterday is dead, tomorrow is not yet born. Yes, live for this very second, the one just past is gone forever, the next one may never arrive. So put all you've got into what you are doing now.



The Ambassador of Better Fusion.

Book Reviews

SYMPOSIUM ON RADIOGRAPHY AND X-RAY DIFFRACTION METHODS. 6x9 in.; 350 pages, 173 illustrations and 13 tables. Cloth binding; price, $4.00. Published by the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa.

Of the 12 papers included in this symposium, the user of welding will find of especial interest the paper on "Radiography in the Welding Shop," by J. C. Hodge, the one on "The Principles of the Radiographic Process," by John T. Norton, and Dr. H. H. Lester's paper on "The Problem of Radiographic Inspection."

The papers mentioned deal with the growth in use of the x-ray for industrial inspection, problems in the practical application of the process, code requirements, principles of radiography, descriptions of radiographic acceptance tests, and discussion of the value of such tests.

• • •

HOW TO WELD 29 METALS, by Chas. H. Jennings. 5¼x8¼ in.; 100 pages, 14 illustrations and 48 tables. Board binding; price, 50 cents. Published by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

Among the 29 metals the weldability of which is discussed in this book, one finds low-, medium- and high-carbon steel, 3½%-nickel steel, various high-strength low-alloy steels, chrome-vanadium and chrome-molybdenum steels, stainless steels, cast iron, and other metals and alloys, both ferrous and non-ferrous. Welding procedures and speeds are considered, together with heat-treatment when air-hardening is a factor. One of the most valuable sections of the book is an extensive table outlining 136 butt and fillet joints of various designs and sizes found frequently in commercial practice, with details given in each case on joint preparation, number of passes and sizes of electrodes, welding current, welding speed and pounds of electrode required per foot of seam. The surprisingly great amount of useful information condensed into these few pages, together with the high degree of accuracy of the data given, could result only from a great amount of time spent in investigation on the part of the author and the exercising of particular care in compiling the information given.

• • •

LESSONS IN ARC WELDING. 8x10½ in.; 60 mimeographed pages, 78 diagrams. Flexible binding; price, 50 cents in the United States, 75 cents elsewhere. Published by The Lincoln Electric Co., Cleveland, O.

This book has been expanded in size from 60 to 130 pages and from 28 to 44 lessons. The lessons are based on the course in arc welding that has been conducted by The Lincoln Electric Co. in its plant welding school for nearly 20 years. The book begins with general fundamental suggestions and takes the student by easy stages through all the important phases of practical arc welding, including instruction on the Lincoln machine, its operation and control, the shielded arc and its uses, striking the arc and running horizontal beads, weaving, effect of arc length and current and speed, effect of polarity, types of electrodes, padding and building up plates, building up shafts, butt, lap and tee welds, vertical and horizontal welding, overhead welding, expansion and contraction, penetration and cutting, mild steel, light-gauge steel, high-tensile steels, cast iron, stainless steels, hard-facing, aluminum, bronze, brass, copper, and 4%-6%-chromium steels. Welding with bare electrode is also covered. To allow the student to test his knowledge, several pages of examination questions are included.

• • •

THE NEW ARC WELDING MANUAL AND OPERATOR'S TRAINING COURSE, by W. J. Chaffee. Second edition; 5½x8 in.; 94 pages, 76 illustrations. Flexible binding; price, $1.00. Published by The Hobart Brothers Co., Troy, O.

Opening with a brief discussion of the welding arc and welding equipment, this manual leads into an explanation of the effects of welding heat on metals, with particular reference to the control of expansion and contraction. The welding of various metals and alloys, both ferrous and non-ferrous, is dealt with, followed by descriptions of typical weld joints. Tabular data are given for calculating sizes and lengths of welds for various loads, as well as information on speed and cost of welding. The manual concludes with 23 practical exercises for the training of welding operators. A great variety of arc-welding applications are illustrated.

• • •

LA SOUDURE A L'ARC ELECTRIQUE. 8½x10½ in.; 284 pages. Published by Office Technique pour l'Utilisation de l'Acier, 25, Rue du General Foy, Paris, France.

This book is divided into three sections, the first treating of arc-welded bridges, the second section dealing with tanks, vessels, pipes, boilers, heavy equipment, watercraft, railroad cars and street cars, and the third section covering testing of welds by the Schmuckler method, by the stethoscope, by magnetic methods, and by x-rays and gamma-rays. The illustrations and diagrams are large in size and clear in details. The section on bridges shows details of 14 European bridges built in recent years by the welding process.

• • •

HENLEY'S TWENTIETH CENTURY BOOK OF FORMULAS, PROCESSES AND TRADE SECRETS, edited by Gardner B. Hiscox. Revised and enlarged edition; 5½x9 in.; 883 pages. Cloth binding; price, $4.00. Published by The Norman W. Henley Publishing Co., 2 West 45th St., New York, N. Y.

This book, containing about 100 more pages than the previous edition, lists more than 10,000 formulas, processes and trade secrets pertaining to a wide variety of subjects, including compounds for forge welding, solders for use with various metals, etching fluids, methods for plating, rules for the alloying and casting of many combinations of metals, waterproofing, cements, enamelling, glues, oils, cosmetics, soaps, coloring of metals, etc.

• • •

BIG BUSINESS: ITS GROWTH AND ITS PLACE. Prepared under the auspices of the Corporation Survey Committee of the Twentieth Century Fund, Inc. 5½x8 in.; 102 pages, 25 tables and 5 charts. Cloth binding; price, $1.35. Published by the Twentieth Century Fund, Inc., 330 West 42nd St., New York, N. Y.

This is the first of three volumes embodying the results of a study of big corporations and their place in American life. The volume under review attempts to show how large big business bulks in comparison with the smaller concerns on the American economic map as a whole, and on the various sectors of the map which represent specific industries and groups of industries. It shows, for example, that individuals and partnerships still carry on almost half of the country's total business. Only 57% of economic activity is incorporated at all, and the proportion that corporations do of total business varies greatly between industries. It is likewise true that the giant corporations are very big indeed. The 594 largest corporations, which are 3/20ths of 1% of the

total number of corporations, owned 53% of the total corporate assets in 1933. Distribution of net income of the largest corporations shows the same high degree of concentration. This report is purely a factual study, and any conclusions given are also factual. After the publication of the two forthcoming volumes, a special committee will formulate a program of action to meet whatever problems the research reveals.

Meetings

Chicago

Talks on heavy welded assemblies will be given at the meeting of the Chicago Section, American Welding Society, to be held on Friday evening, March 19, in the Spanish Room, 23rd floor, Medical and Dental Arts Building, 185 N. Wabash Ave.

H. J. Shiffli, welding engineer, American Steel Foundries, will speak on "The Use of Castings in the Assembly of Heavy Welded Sections." J. D. ("Jack") Gordon, of the Welding Fabrication Division of the Taylor-Winfield Corp., Detroit, will speak on "Assembly of Heavy Sections by Welding" and will illustrate his talk with motion pictures. The chairman of the meeting will be J. I. Banash, consulting engineer, of Chicago. The meeting, starting at 7:45 p. m., will be preceded by a baseball movie and a cartoon comedy. Dinner will be served at 6:30, also in the Spanish Room.

A good-sized delegation is expected from Milwaukee, since the members of the Milwaukee Section have received invitations to attend this meeting. At the meeting on Feb. 19, addressed by L. C. Bibber, and by O. W. Howland, who read Mr. Long's paper, more than 150 were in attendance.

• • •

Los Angeles

Four interesting talks were features of the February 18th meeting of the Los Angeles Section of the American Welding Society, at which 85 members and guests were present. The meeting was presided over by the new chairman, Wayne A. Howard, who announced the new committee members for the coming year.

B. J. Brugge, formerly welding engineer for the Anglo-Persian Oil Co., of Abadan, Persia, and at present sales engineer for The Lincoln Electric Co., analyzed the articles and data presented in the February issue of *The Welding Journal*. Arthur Beggs, western sales manager of the American Airlines, Inc., gave a talk on "Modern Air Transportation," describing an imaginary trip to New York on one of the new sleeper planes. Kenneth Anderson, Pacific-coast representative of Steel & Tubes, Inc., spoke on "The Manufacture of Welded Tubes and Pipe by the Continuous Electrical Resistance Process." His talk was illustrated by motion pictures, showing manufacturing processes. Numerous specimens of tubing and tubing tests were presented for inspection. The last feature of the meeting was a talk and motion picture of the welding arc, by Charles Babbitt, welding foreman, Western Pipe & Steel Co.

The newly elected officers of the Los Angeles Section are: Chairman, Wayne A. Howard, inspection supervisor, General Petroleum Corp.; vice-chairman, P. D. McElfish, materials engineer, Standard Oil Co. of California; and secretary and treasurer, Russell L. Graves, welding supervisor, Union Oil Co. of California. The members of the Executive Committee are: James C. Blake, manager, Victor Equipment Co.; Lloyd Earl, production superintendent, Consolidated Steel Corp.; James C. Gowing, of James C. Gowing Co.; Chester Mott, manager, National Cylinder Gas Co.; and Harold Whittlesey, consulting structural engineer.

• • •

Milwaukee

"Some Metallurgical Aspects of Arc Welding" was the subject of a talk by J. C. Joublanc, chief metallurgist of the Harnischfeger Corp., at the meeting of the Milwaukee Section, American Welding Society, held on Feb. 26.

• • •

New York City

Shipbuilding will be the subject covered at the monthly meeting of the New York Section, American Welding Society, to be held on April 13, at the Engineering Societies Building. A joint session of the New York Section with the American Society for Metals will be held on April 19, with the subject: "Stresses in Welds and Their Elimination." The annual business meeting of the Section will be held on May 11, at which meeting motion pictures of new developments in welding will be shown. "Welded Structures for Hydraulic Turbines" was the subject of the paper presented by George A. Jessup, chief engineer, S. Morgan Smith Co., York, Pa., at the meeting of the New York Section held on March 2.

• • •

Philadelphia

At the meeting of the Philadelphia Section, American Welding Society, to be held on April 19th, T. R. Lichtenwalter, of the Republic Steel Corp., will speak on "Manufacture, Uses and Applications of Enduro Stainless Steel." Sound motion pictures will accompany the lecture. "The Electric Welding of Monel, Nickel and Nickel-Clad Steel" was the subject of a lecture presented by F. G. Flocke, technical service engineer, International Nickel Co., at the Feb. 15 meeting of the Philadelphia Section. "Solving Manufacturing Problems by Welding" was the subject of a paper by Charles H. Jennings, of the Westinghouse Electric & Manufacturing Co., given at the March 15th meeting.

• • •

Pittsburgh

G. O. Carter, consulting engineer, of The Linde Air Products Co., New York, N. Y., was the speaker at the meeting of the American Welding Society, Pittsburgh Section, held on March 17. The subject of Mr. Carter's address was, "Past and Future of Welding in the Pittsburgh District." The next meeting of the society, which will be the last one of this winter, will be held at the Roosevelt Hotel on April 21, at which time R. B. Lincoln, of the National Weld Testing Bureau, will be the speaker.

• • •

Rockford, Ill.

At a meeting of the Rockford Engineers Society held on the evening of March 9, motion pictures of the assembly and welding of heavy plate structures were shown by J. D. Gordon, of the Fabricating Division, Taylor-Winfield Corp., of Detroit.

• • •

San Francisco

At the February 26th meeting of the San Francisco Section of the American Welding Society, Chairman E. L. Mathy gave a brief outline of the planned program for the coming year, and K. V. King called attention to recent important publications and literature pertaining to welding and cutting. The main speaker of the evening was Harold Bell, Service Operator of the Linde Process Service Dept., who presented a paper, illustrated with lantern slides, on the subject "Oxyacetylene Cutting and Manufacture and Utilization of Rolled Steel."

Coming Events

Mar. 24-26. Ames, Iowa. Ninth Annual Welding Conference of Iowa State College, with exhibits. For information write D. C. Faber, Director, Engineering Extension Service.

Apr. 8-11. Minneapolis, Minn., Auditorium. Northwest Automotive Maintenance Show. For information write H. H. Cory, 303 Tribune Annex, Minneapolis, Minn.

Apr. 29-30. Madison, Wis. Annual Welding Conference at University of Wisconsin, with exhibits. For information write J. M. Dorrans, Superintendent of Engineering Shop Laboratories.

May 3-7. Milwaukee, Wis., Municipal Auditorium. Annual Convention of American Foundrymen's Association. For information write C. E. Hoyt, Secretary, 222 W. Adams St., Chicago, Ill.

May 24-27. Atlantic City, N. J., Auditorium. Annual Meeting of National Association of Master Plumbers.

June 28-July 2. New York City, The Waldorf-Astoria. Fortieth Annual Meeting of American Society for Testing Materials, and exhibit of testing apparatus and related equipment. For information write C. L. Warwick, 260 S. Broad St., Philadelphia, Pa.

What's New in Equipment and Supplies

A. C. Welder With Remote Current Control

A new "Gen-Arc" a.c. welder has been announced by The General Equipment Co., 311 S. Wichita St., Wichita, Kan., which incorporates several new features, foremost of which is the elimination of all manual controls, switches, plugs and wires for changing welding heats. A remote-control unit operating from the electrode-holder handle gives the operator complete control of all current

Illuminated Dial Shows Ampere Setting.

positions without the operator leaving the welding job. An illuminated dial on the welder permits the operator to see at a distance the exact current setting of the machine.

Solder Spray Gun for Auto Body Repair

A gun that sprays solder like paint, for use on repair work on automobile bodies and fenders, has been announced by the Ernest Holmes Co., Chattanooga, Tenn. This device, known as the Holmes-Taywal Metal Spray Gun, shoots solder on dented steel or aluminum surfaces with the same ease and speed that a

Gun for Spraying Molten Solder

paint gun sprays paint. By preparing the dents with Holmes Cold-Tinning Compound, no acids or heat is applied to the metal surface, and there is no heat buckling or warping, it is claimed.

The tinning compound is applied to the body metal and rubbed in until a bright tin surface appears, which forms a firm base that adheres to the solder and the body panel. The sticks of solder are fed into the gun near the nozzle, after the gun has been connected to a light socket and attached to the shop air line. The 300-watt heating element melts the solder, which is blown in finely divided particles onto the surface to be coated.

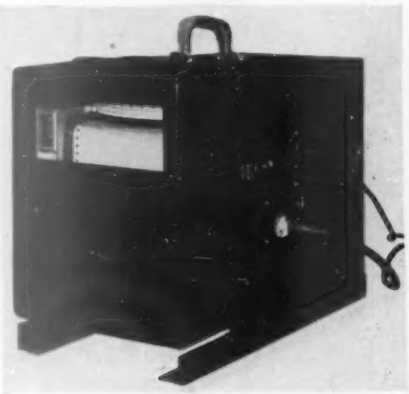
It is claimed that the gun will not overheat, even with the air shut off. Air is used only when actually spraying—none being wasted. The handle stays comfortably cool, it is claimed, and the nozzle is protected against damage. The gun is attractive in appearance and weighs only 2½ lb.

Instrument for Checking Electrodes and Deposits

The Arcronograph, a recording instrument recently put on the market by the Rubicon Co., 29 N. Sixth St., Philadelphia, Pa., provides a constant method of inspection during welding. For each type and size of electrode, it produces a chart of definite appearance as representative of the normal or desired performance. Irregularities of harmful magnitude are said to cause sufficient deviation from the normal chart that the interpretation is simple enough to the welder after he becomes acquainted with the relationship between the record and the weld metal.

The value of this instrument lies in the fact that this standard record, made under predetermined and known conditions, serves as a basis to which all subsequent records can be compared for determining any variation in the rhythm or cadence resulting from the formation and transfer of the molten electrode metal. Since this cadence (or ratio between the formation time and the transfer time) should be essentially constant for the particular electrode used, the graphic record shows how consistently the welder has maintained correct arc conditions.

Satisfactory limits within which the record must be maintained are obtained by initially depositing a given electrode under known conditions and then observing the relation between the type of the



Arcronograph for Checking Welds.

record and the results of the test work. Thus, one can set lower and upper limits beyond which the recorded graph must not move, and where the record moves outside these limits that portion of the weld is viewed suspiciously and is carefully examined with a view to having it chipped or otherwise corrected.

The regular cadence of the arc stream may be disturbed by extinction of the arc or by lengthening or shortening of the arc gap. The Arcronograph record indicates when any of these irregularities occur. The amplitude and the time element of the disturbance may be seen by the operator as soon as he finishes depositing an electrode.

The Arcronograph is self-contained and portable, for use in the laboratory, shop or field. It operates in parallel with the welding circuit and requires a fairly steady source of alternating current for operating the vacuum tubes, relays and synchronous-motor-driven clock. The record is produced on a 5-in. strip chart, moving at a speed of 3 in. per minute.

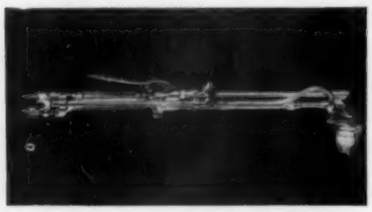
The instrument may be used when welding pressure piping or pressure ves-

Applying Solder to Automobile Body.

sels, checking unknown against known electrodes, determining an applicant's aptitude for welding, checking welds for defects when qualifying operators, and determining critical ranges for various types of electrodes. It is already recognized by some leading organizations as a valuable aid in the production of good, sound welds.

Submarine Cutting Torches for Greater Depths

In the construction of large dams, such as the Grand Coulee, and large bridges, such as the San Francisco-Oakland Bay Bridge and the Golden Gate Bridge, underwater cutting must frequently be undertaken, and occasionally at great depths below sea level. While the Victor Welding Equipment Division of the Victor Equipment Co., San Francisco, Calif., heretofore produced underwater cutting torches quite adequate for shallow depths, the particular operations



"Victor" Submarine Cutting Torch.

mentioned have afforded an excellent opportunity to develop a heavy-duty underwater cutting torch.

For greater depths, hydrogen is used as a fuel gas and the design of the torch is such that it is easy to handle by the diver, it being provided with an adjustable compressed-air jacket and permitting ready exchange of a 90°-angle cutting head for a straight head assembly. The construction of the torch is sturdy enough to withstand usage at the lowest encountered depths.

Respirator for Welding or Paint Spraying

The M. S. A. Air Line Respirator, for full protection against fumes encountered in welding, cutting and paint-spraying operations or other processes requiring respiratory protection, has been put on the market by the Mine Safety Appliances Co., Pittsburgh, Pa.

Compressed air at low velocity is supplied through a large-diameter "non-kinking" flexible tube, entering the U. S. Navy type facepiece through a deflector that keeps the air from striking the face. The flow of air is controlled by a "pump-proof" valve at the wearer's belt. The adjustment of the valve cannot be disturbed accidentally.

A quick-release attachment is provided to disengage the respirator from the supply hose in case of air failure or similar emergency, and a chemical cart-

Provides Protection Against Fumes.

ridge for removing small quantities of oil, vapor or foreign substances from the compressed air is optional equipment.

The unit is light and comfortable, permits the wearing of goggles, and offers complete working freedom.

Motor-Driven Portable Shear for Sheet Metal

A motor driven hand shear, for cutting sheet metal up to 16 gauge, is being sold by Tanner & Co., Indianapolis, Ind., and was demonstrated by them at the Purdue Welding Conference in December. This shear will cut 16-gauge

Shearing Sheet Metal.

hot-rolled steel at a speed up to 15 ft. per minute. It cuts straight lines, curves, angles and notches with high accuracy, and turned-up edges can be cut close to the surface. Inside cuts can be made by punching a 2-in. hole in the material and slipping the yoke through the hole.

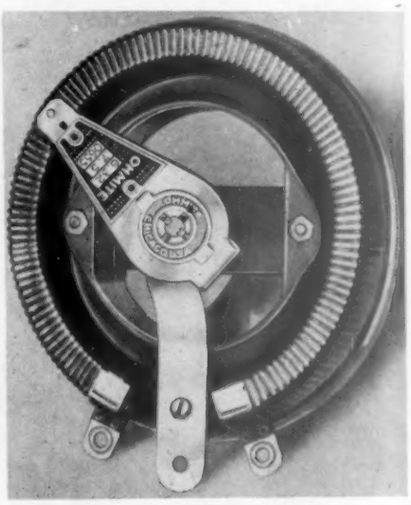
This device, known as the No. 16 Unishear, is surprisingly light, making

Motor-Driven Hand-Guided Shear.

it easy to handle. The pivoted handle permits using the machine in many positions and provides a comfortable grip for the operator. A double-pole toggle control switch is located in the handle. The blades are interchangeable and are easily removed for sharpening.

1-Kw. Rheostat for Current Control

For generator field control of arc-welding machines, speed control of small motors, and for many other purposes, a power rheostat rated at 1 kw. has been developed by the Ohmite Manufacturing Co., 4835 W. Flournoy St., Chicago, Ill. This device, known as the Model "U" rheostat, is 12 in. in diameter and is of the wire-wound type, thus allowing close graduation of control. It is constructed of metal and ceramic materials throughout. The resistance wire is wound over



12-In. Rheostat of Wire-Wound Type.

a horseshoe-shaped porcelain core mounted on a porcelain base. The entire unit, with the exception of the contact surface, is then covered with vitreous enamel and fired at a high temperature.

New Line of A. C. Welders

The "King" arc welder has been announced by The Electric Heat Control Co., Cleveland, O., and is available in two sizes. The larger size, known as Type W-1, has a welding-current range of 20 to 150 amperes, in 8 steps. The current rate is changed by means of a control switch, above which is a "window" indicating the ampere rate. There are no exposed live parts, no plugs, no jumpers or any connections to make. It is only necessary to set the indicating dial at the desired rate and close the switch. This unit is equipped with large rubber-tired swivel casters.

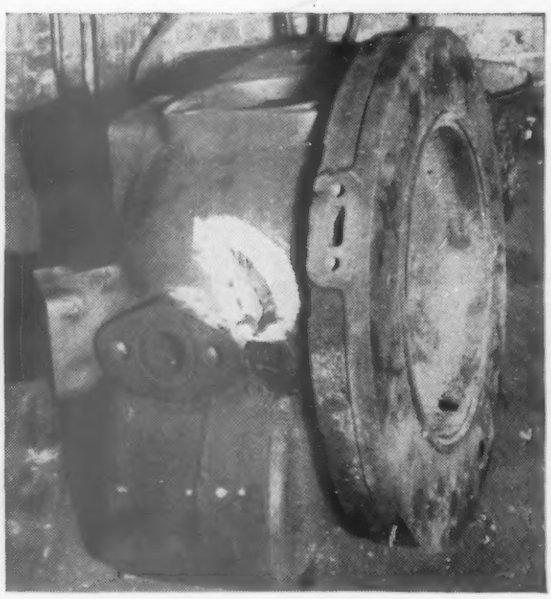
The smaller unit, known as Type W-2, has a capacity of 20 to 70 amperes, con-

$2,000 replacement cost

Saved by Tobin Bronze!

2 cracked Diesel engine heads repaired "like new" in short time and at small expense

Water jacket repair is shown above



Valve port was welded as shown here

HERE is how one pound of Tobin Bronze in less than two hours saved $2,000 and weeks of delay. Cracks in these two Diesel engine heads developed—one on the outside of the water jacket and the other on the inside of a valve port.

A welding operation with one pound of Tobin Bronze and 28 feet each of oxygen and acetylene did the job. In less than two hours, these four hundred pound castings were repaired. After the valve seats were ground, the heads were put back in service. *New heads would have cost $1,000 each and would have meant weeks of delay because the castings were made abroad.*

This is another of many instances where Tobin Bronze welding has saved money and time for plant owners. It confirms the verdict of experienced welders that Tobin Bronze is a *better* welding rod.

Tobin Bronze carries the trademark "Tobin Bronze Reg. U.S. Pat. Off." on each rod. Look for it. Be sure you are getting the genuine Tobin Bronze. 87357

ANACONDA
from mine to consumer

Anaconda Welding Rods

THE AMERICAN BRASS COMPANY • General Offices: Waterbury, Connecticut

Offices and Agencies in Principal Cities • In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ont.

"King" Welder Rated Up to 150 Amperes.

stant service, and a high tap of 100 amperes for intermittent use only. It will operate from either 110 or 220 volts.

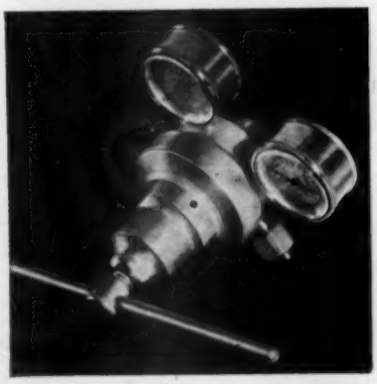
Brazing Flux for Iron and Bronze Castings

For bronze welding cast iron, steel, aluminum bronze, malleable iron, copper and brass, the "Brazall" brazing flux has been announced by F. R. Faulk, 405 Penn Ave., Pittsburgh, Pa. It is said that this flux readily tins cast iron at all temperatures. It runs freely ahead of the brazing operation, and only a small amount is required for the ordinary job. When using this flux, it is said that the bronze retains its original bright color. It is applied by dipping the rod into the flux.

Regulator for High Delivery Pressures

For laboratory use, the Victor Equipment Co. of San Francisco, Calif., has developed a new regulator usable for primary pressures exceeding 3,000 lb. and for delivery pressures ranging from 1 to beyond 1,000 lb. per sq. in.

Since pressure-reducing regulators for gas welding and cutting cannot be utilized safely for delivery pressures beyond 500 lb. per sq. in., the new Victor Type V-50XXX fills the requirement for a regulator that will operate with high accuracy and safety at these higher pressures.



For Delivery Pressures Up to 1,000 Lb.

The regulator body and spring housing are made of steel, cadmium-plated internally and externally, and the regulator is provided with a very large tension screw and handle to facilitate easy pressure adjustments.

These regulators initially were designed and constructed primarily for oil-refinery laboratories, but have since been utilized by many different types of laboratories where high initial gas pressures require reduction to broad delivery pressure ranges. The internal mechanism of these regulators is basically identical with the Victor "Safety" regulators used in the welding industry and for medicinal purposes.

The Victor Equipment Co. now offers pressure-reducing regulators in five different design types and in several sizes for virtually all high-pressure cylinder gases.

Trade Literature

The Aluminum Co. of America, Pittsburgh, Pa., has issued an attractively bound booklet of 44 pages, "The Welding of Aluminum." Illustrated with both explanatory line drawings and photographs, the booklet is a complete, concise description of aluminum welding processes. Such subjects as "Arc Welding Aluminum" and "Torch Welding Heat Treated Aluminum Alloys," are explained in an interesting manner.

Hoists are described and shown in a new bulletin issued by the Harnischfeger Corp., 4513 W. National Ave., Milwaukee, Wis. In addition to showing more than 25 industrial application photographs, the bulletin describes the added advantage in handling "off-the-floor." Diagrams deal with simplified construction and operation, and ratings and operating ranges are listed.

A 127-page, profusely-illustrated catalog of industrial safety equipment has been issued by the Mine Safety Appliances Co., Pittsburgh, Pa. Among the items featured are welders' goggles, helmets and gloves, and a complete line of respirators, including devices for protection against fumes encountered in welding, cutting and spraying operations.

"Nickel Alloy Steels in Petroleum-Production Equipment" is the title of Bulletin U-2, published by The International Nickel Co., Inc., 67 Wall St., New York, N. Y. A diagram of a typical drilling rig and pumping rig is shown, and types of steels for various parts are suggested, on the basis of service requirements.

Welding and cutting torches, submarine cutting torches, regulators, goggles, helmets, electrode holders and New-Way lighters, are listed and described in a folder issued by Torch Supply & Engineering, 1637 E. Vernon Ave., Los Angeles, Calif. A paragraph is also devoted to the repair department of the company.

"Goggles" is the title of Safe Practices Pamphlet No. 14, recently published by the National Safety Council, Inc., 20 N. Wacker Drive, Chicago, Ill. The pamphlet deals with selection of goggles, lenses and cover glasses, sterilization, tests, fitting, fogging, inspection, defective vision and discipline.

Page Hi-Tensile F electrodes are described, together with the shielded-arc method of welding, in booklet No. DH-984, recently issued by the Page Steel & Wire Division of the American Chain & Cable Co., Inc., Monessen, Pa. Procedures for various types of welds are illustrated.

Engine-driven arc welders are described and specifications given in two bulletins recently issued by The Lincoln Electric Co., Cleveland, O. Bulletin No. 318 is devoted to Type S-6005, rated at 200 amperes, and Bulletin No. 320 describes Type S-6018, rated at 400 amperes.

Physical properties, recommendations and specifications of Electroloy alloys for all types of resistance-welding equipment, including spot, seam, projection, flash and butt welding, are given in a new catalog issued by the Electroloy Co., Inc., 50 Church St., New York, N. Y.

Protective leather supplies for welders, including gloves and mittens, sleeves, aprons, jackets and coats, overalls, leggins, hoods and helmets are described in a new catalog by John Tillman & Co., Long Beach, Calif. Several samples of leathers are included.

"Copper Alloy Bulletin," issued by the Bridgeport Brass Co., Bridgeport, Conn., made its appearance with the March issue, containing a digest of re-

MARCHING ON!

— to greater success in the Research of Welding

Welding Research Committee

sponsored Jointly by

AMERICAN WELDING SOCIETY
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

• Purposes and Activities

The Welding Research Committee was organized in 1935, by the Engineering Foundation and Sponsored jointly by the American Welding Society and the American Institute of Electrical Engineers.

Its purpose is to assemble and digest all information regarding welding research, correlating existing and future programs of welding research. Its activities are divided into three classes, namely, Literature, Fundamental Research and Industrial Research.

• Advancement Through Research

Improvements in welding technique, materials, etc., have been phenomenal in the past decade. Tensile strengths of the average welded joint have been raised from between 40,000 and 50,000 lb. per sq. in. to from 65,000 to 75,000 lb. per sq. in. With special steels and materials, 100,00 lb. per sq. in. is not impossible. Also the ductility of the weld metal has increased from 10 to 30 per cent; the fatigue endurance limit has risen from 10,000 to 28,000 lb. per sq. in.; and impact resistance as indicated by the Izod test, has jumped from 5 to 50 ft.-lb. or more. In spite of these advances in welding, only the surface has been touched, so that new opportunities are almost limitless in their extent.

• Scope and Value of Work

The Literature Committee will prepare a critical digest of the World's Welding Literature, also publish a series of books summarizing the best available knowledge in each part of the field.

The Fundamental Research is a carry-over from the American Bureau of Welding and has many accomplishments to its credit. There are over 50 active research projects in many universities throughout the country. Their purpose is to educate professors and students of the institution in question, thus supplying the demand of young engineers. This constitutes a contribution to those industries concerned with the future of welding.

The Industrial Research Committee is to coordinate industrial research without trespassing upon fields of a temporarily confidential nature.

For further information address: American Welding Society, 29 West 39th Street, New York, or A. F. Davis, Chairman Membership Committee, P. O. Box 5758, Cleveland, Ohio, or THE WELDING ENGINEER, 608 South Dearborn Street, Chicago, Ill.

cent information and new developments of interest to industrial consumers of copper and copper alloys.

Will-Weld a.c. welders are described in a folder issued by the Will-Weld Manufacturing Co., 600 South 15th St., Omaha, Nebr., with particular emphasis laid on the advantages of impedance control—one of the features of this line.

Spot-welding tips and tip holders are described in a folder issued by the S-M-S Corporation, 1165 Harper Ave., Detroit, Mich. Various forms of water-cooled holders are described, all with replaceable tips.

"Nico Does the Job" is the title of a folder issued by American Arc Welders, Roseau, Minn., describing procedure that has been found successful in arc welding cracked water jackets with "Nico" electrodes.

"Fluxes: Their Function in Metallic-Arc Welding" is the subject of an article by D. L. Mathias, in the December, 1936 issue of "Foote-Prints," issued by the Foote Mineral Co., Philadelphia, Pa.

Metallizing is discussed at length and a great many applications shown in a 36-page booklet just issued by the Metallizing Co. of American, Inc., 1218 Long Beach Ave., Los Angeles, Calif.

Indicating instruments for replacement on panels of G-E arc-welding sets are listed in Bulletin GEA-21908, issued by the General Electric Co., Schenectady, N. Y.

The advantages of Agile mirror lenses in reducing eye fatigue when welding, are described in a folder recently issued by the American Agile Corp., Cleveland, O.

High-speed diesel power units (Model 36-A) are described in Bulletin 3600-A1, issued by Fairbanks, Morse & Co., Chicago, Ill.

Commercial News

Una Elects New Executives

Una Welding, Inc., Cleveland, O., have reorganized their executive staff, with the addition of W. K. Cooper as executive vice-president and general manager, A. A. Probeck as vice-president and sales manager, and R. B. Fehr as chief engineer. Mr. Cooper comes from the New York Shipbuilding Corp., Camden, N. J., where he served as assistant general manager, and was formerly with the Spicer Manufacturing Corp., in an executive capacity. Mr. Probeck, who was a Una sales representative from 1927 to 1931, rejoins the company after having served the Federal Machine & Welder Co., Warren, O., in an executive capacity. Mr. Fehr has served as development engineer for the Rail Welding & Bonding Co., of Cleveland, and technical director for Gear Processing, Inc., of Detroit and Cleveland.

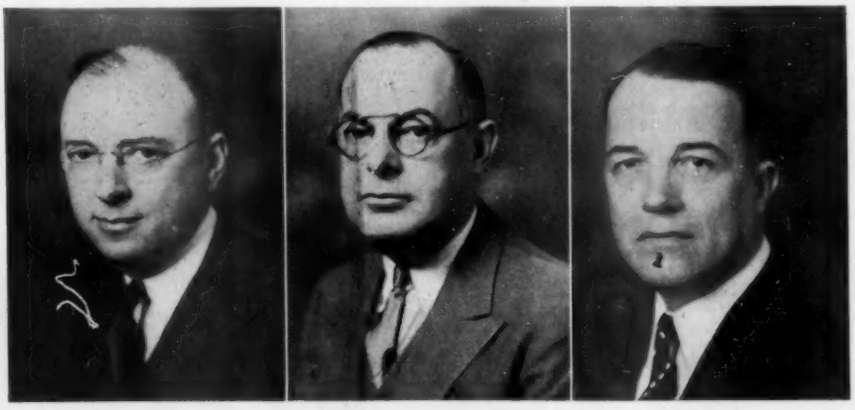
An increase of 50% in sales during the first two months of this year as compared with the corresponding period of last year is reported by the J. D. Adams Co., Indianapolis, Ind., along with the announcement that Adams is introducing four entirely new welding electrodes. In addition to a complete line of welding equipment, the company now manufactures and carries in stock over twenty-five distinctly different electrodes, all with different analyses and coatings. The new electrodes give Adams one of the most complete lines of electrodes now available to the industry. Recently the company received two of the largest orders for arc welders in its history, these to be employed in the manufacture of petroleum pressure vessels and in heavy plate and structural fabrication.

The Air Reduction Sales Co., New York, have announced the following changes affecting the personnel of their district offices: H. F. Henriques and J. J. Lincoln, Jr., have been appointed assistant general sales managers of the company, with headquarters in Cleveland and Pittsburgh, respectively. Both were formerly managers of their respective districts. J. M. Driscoll has been promoted from assistant sales manager to acting manager at Cleveland, and S. D. Edsall has received a similar promotion at Pittsburgh. A. W. Brown, formerly manager of industrial gas sales for Pure Carbonic, Inc., an Air Reduction subsidiary, has been appointed assistant railroad sales manager. J. F. Pryor, formerly assistant to the general sales manager, has been appointed vice-president of the Magnolia Airco Gas Products Co., with headquarters at Houston.

The Federal Machine & Welder Co., Warren, O., is to be acquired by a group of eastern industrialists, if negotiations now under way are completed, according to Mrs. Zella A. McBerty, secretary-treasurer of the company. The company, incorporated in 1917 with a capital stock of $200,000, manufactures resistance welders and employs 180 persons. The plant, 90x270 ft., with a three-story office building, is on a three-acre site on Dana Avenue. Completion of the purchase is not expected before April 1. Under the plan, Mrs. McBerty would retire and Mr. McBerty remain as operating head for a time. The new owners would continue with the present plant and may contemplate expansion.

The Torchweld Equipment Co., 1035 W. Lake St., Chicago, Ill., have added Guy M. Neagley to their sales force in the Pittsburgh territory, working in cooperation with their distributor, Williams & Co., of Pittsburgh. Mr. Neagley's 20 years' experience in the oxy-acetylene welding and cutting industry makes him particularly well qualified to assist users of welding and cutting in the solution of their problems.

Edward M. Sexton, railroad sales manager of the Air Reduction Sales Co., New York City, died on Feb. 15 after an illness of several weeks. He joined Air Reduction in 1916 as a salesman in the Metropolitan distict, later becoming manager of the Chicago district, and then manager of the Metropolitan district. He had been manager of the railroad sales department since 1922.



W. K. Cooper A. A. Probeck R. B. Fehr

NEW EXECUTIVES OF UNA WELDING

Fred G. Squire and "Jack" Cunningham have organized the F. G. Squire Co., at 4720 Van Buren St., Chicago, Ill., to sell and repair oxyacetylene welding and cutting equipment, including equipment of the Gas-O-Machine Products Co., Chicago. Both men are well-known in the welding field in Chicago, having been connected with the trade for about 20 years.

H. H. Hoover, president of the Electro Cover Glass Co. and of the H. H. Hoover Co., Pittsburgh, Pa., died recently at the Mercy Hospital, Pittsburgh, at the age of 58, following an attack of influenza that developed into pneumonia. Mr. Hoover had headed the Electro Cover Glass Co., since September, 1935.

J. C. Joublanc has been appointed chief metallurgist of the Harnischfeger Corp., Milwaukee, Wis. For ten years he was connected with the Republic Steel Corp. and for four years was with the welding development and research department of one of the country's leading welding-equipment manufacturers.

Warren Howland Jones, secretary, assistant treasurer and director of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., recently died of pneumonia. C. W. Pomeroy has been elected to the position of secretary, and Albert Olsen has been elected assistant secretary.

Compressed Industrial Gases, Inc., Chicago, Ill., have opened two new stores with complete stocks of equipment and supplies for gas and electric welding and cutting, these being located at 1311 S. Mint St., Charlotte, N. C., and 120 S. St. Francis St., Wichita, Kan.

Malton A. Teeter, of the Long Beach (Calif.) Welders' Supply Co., recently purchased his father's (C. A. Teeter) interest in the business, and moved from 1326 to 1282 West Anaheim St. Mr. Teeter handles a complete line of acetylene apparatus, arc welders, rods, etc.

In the announcement in last month's issue of the appointment of the Pipe Welding & Supply Co., Elmira, N. Y., as distributor for "Rego" welding and cutting equipment, the first word in the company's name appeared as "Type," for which apologies are due them.

The Ben Sibbett Iron & Foundry Co., Wichita, Kan., has been appointed distributor of "Rego" welding and cutting equipment by The Bastian-Blessing Co., Chicago.

Dr. Elihu Thomson, originator of the resistance-welding process and for more than fifty years associated with the General Electric Co., died at his home in Swampscott, Mass., on March 13, at the age of almost 84 years. He was the holder of about 700 patents.

The Machinery & Welder Corp. announce an increase in their warehouse facilities in Moline, Ill., for serving the Tri-City area. The company's Kansas City warehouse has been moved to new quarters at 1414 McGee St., doubling the present warehouse space.

New officers of The Oster Manufacturing Co., Cleveland, O., have been announced as follows: Chairman of the board, R. B. Tewksbury; president and treasurer, Roger Tewksbury; vice-president, Arthur S. Gould; and secretary, Harry A. Maurer.

The Stambaugh-Thompson Co., Youngstown, O., will hold an industrial exhibit on March 30 and 31, at which "Rego" welding and cutting equipment will be demonstrated by H. O. T. Ridlon, district manager for The Bastian-Blessing Co.

A total of 1,784, and an additional 520 students, were registered at the welding confab held by the Commercial Gas Co., in Minneapolis, Minn., March 3 to 6, with the cooperation of manufacturers of products handled by the company.

The Balbach Co., Omaha, Nebr., have taken on the distribution of Wilco a.c. arc welders, according to B. W. Criswell, manager of sales. The company is planning to hold welding schools throughout the year in the states of Nebraska and Iowa.

N. B. Gilliland, who for the past year has been assistant instructor of welding at The Ohio State University, Columbus, O., has joined the sales engineering staff of the Detroit office of The Lincoln Electric Co. at 2457 Woodward Ave.

The Wayne Welding & Supply Co., 517 E. Wayne St., Fort Wayne, Ind., have been appointed jobbers by the New Process Plow Welding Co., Perry, Iowa, for their line of reclaiming units for plows and other farm implements.

The Southwestern Welding Conference will be held in Chattanooga, Tenn., on April 20 to 23, under the auspices of the Chattanooga office of Compressed Industrial Gases, Inc., according to J. D. Williams, district sales manager.

The American Rolling Mill Co., Middletown, O., has opened an office in the Circle Tower, Indianapolis, Ind., in charge of Austin Edwards, for many years associated with the Middletown sales district.

A. W. Kaiser, district manager of The Linde Air Products Co. in Milwaukee, recently passed away. He had been in charge of the Linde Milwaukee district for the past 15 years, and for 10 years prior to that he served as a salesman in the same district.

The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., have

RYERSON *a dependable source for* WELDING ROD

Ryerson Engineers have developed a series of rods that are outstanding for Quality production. More than twenty types including both electric and gas rods are carried in stock. Whether you need a shielded arc type for production work or a stainless steel rod you can be sure of immediate shipment.

ELECTRODES

Ryerson Shielded Arc Type No. 215
Ryerson Shielded Arc Type No. 216
Ryerson Shielded Arc Type No. 217
Ryerson Green Processed No. 18
Ryerson Green Processed No. 6
Ryerson Bare Mild Steel
Ryerson Brown Processed
Ryerson White Flux Coated
Ryerson High Carbon White Flux Coated
Ryerson Blue Flux Coated
Ryerson 3½% Nickel Steel Flux Coated
Ryerson High Manganese Steel
Ryerson Hard Surfacing
Ryerson Allegheny Stainless Flux Coated
Ryerson Allegheny Stainless No. 44

GAS RODS

Ryerson Copper Coated No. 206
Ryerson Copper Coated No. 210
Ryerson Cast Iron
Ryerson 3½% Nickel Steel
Ryerson Tobin Bronze
Ryerson High Carbon Bare No. 2110
Ryerson Allegheny Stainless Bare
Ryerson Hard Filler

Write for descriptive bulletin

JOSEPH T. RYERSON & SON, INC.

Chicago. Milwaukee. St. Louis. Detroit. Cleveland. Cincinnati. Buffalo. Boston. Philadelphia. Jersey City

appointed two new welding dealers, these being The Foremost Electric Co., 213 E. Franklin St., Peoria, Ill., and the Moline Welding Service, 840 Third Ave., Moline, Ill.

The most successful welding confab ever held by the Omaha Welding Co., Omaha, Nebr., was that on March 10 to 12, at which 310 were registered compared with 254 at last year's confab.

R. D. Jenkins & Sons, 202 E. Second St., Reno, Nev., have been appointed by the Harnischfeger Corp., Milwaukee, Wis., as exclusive agents for excavators and welders in western Nevada.

The Cleveland, O., office of The Lincoln Electric Co. has been moved from 5th and Baymiller Sts., to Room 602, American Building, at Central Parkway and Walnut Street.

Henry Booth, sales manager of Shawinigan Products Corp., New York City, has just been elected president of the Chamber of Commerce at Westport, Conn.

Arthur E. Gaynor has been appointed manager of the New York branch of the John A. Roebling's Sons Co., succeeding W. P. Bowman, deceased.

Gust Nyquist, of the American Arc Welders, Roseau, Minn., recently died. Joel Nyquist has taken over the management of the company.

John S. Humble has been appointed arc-welding consultant for the Boston office of The Lincoln Electric Co., at 10 High St.

Notes From the Field

It looked very much as if a large rotary dryer had outlived its usefulness for the Penn Tobacco Co., Wilkes-Barre, Pa. At least so thought John Uhl, president of the company. The company faced an expenditure of several thousand dollars for new equipment. With little hope of salvaging the broken-down dryer, the tobacco company called on the Wilkes-Barre Welding Co., owned and operated by J. Lin Johnson, to see what they could do. Johnson put his crew of welders, with portable equipment, to work on the dryer, and after several nights of work they practically rebuilt the dryer and put it again in first-class operating condition, with the repair job costing only a small fraction of what a new drier would have cost.

A 1,000-gallon gasoline tank that has outlasted three trucks, the third badly damaged after overturning down a steep embankment, was recently rewelded to the trailer of the truck trailer by the Southern Welding Co., 415 W. Market St., Johnson City, Tenn. "Three years ago," said Mayland H. Muse, proprietor of the welding company, "we remade the tank from one of 600-gallon capacity, by welding, for the Gulf Refining Co., distributor of Johnson City. Each time a new truck was purchased the tank was welded to the trailer. Then came the accident to the third, and the tank and trailer were brought to us for remounting. Upon examination we failed to find a leak in the tank."

The first of seven all-welded oil barges for the American Barge Line Co. has just been completed on the marine ways of the Dravo Corp. at their Neville Island yard near Pittsburgh. These barges, which have three compartments each, are somewhat similar in construction and appearance to the standard coal barge, with the exception that the inside hoppers run to the bottom of the barge. Each are 175 ft. long, 26 ft. wide and 7 ft. 8 in. deep. The decks have been raised to give additional capacity, and as a result each of the barges will hold 6,000 barrels of petroleum products. They will be used in inland waterway trade between Pittsburgh and Southern ports, chiefly Louisville, New Orleans and Memphis.

Much welding—and work calling for a high degree of precision in its execution—will be under way shortly by the Consolidated Steel Corp., of Los Angeles, Calif., in connection with the construction and erection of a 750-ton revolving dome on Palomar Mountain in southern California, to house the new large telescope for the California Institute of Technology, the welded framework of which was described in the January issue of *The Welding Engineer*. The dome, or steel lid, beneath which the giant eye will blink at the heavenly bodies, will measure 135 ft. in diameter, or 35 ft. larger than the present Carnegie Institution's Mt. Wilson telescope dome—the world's largest at this time.

Paschall Welding Service has removed its welding school to larger quarters at 5929 Woodland Ave., Philadelphia, Pa., opposite the Brill car-building plant. Day and evening classes are conducted in arc and oxyacetylene welding. Facili-

● *THE NEW* **DOCKSON**

TURRET-TYPE

WELDING SHIELD

Pat. Apd. For

GIVES GREATER STRENGTH, ECONOMY AND SAFETY

Rivetless face-piece, formed from seamless heavy-gauge fibre sheet, eliminates all possibility of electric shock through the shield—permits easy, complete sterilization—and insures exceptionally long life with maximum economy.

UNIQUE LENS HOLDER PROVIDES ECONOMY AND CONVENIENCE

Made from special oil and heat resisting compound—reduces breakage and allows for instant changing of cover without removing colored glass.

NEW HEADGEAR GIVES EXTRA COMFORT

Instantly adjustable, really fits all heads—with new detachable head-pad that affords maximum comfort.

● IF YOUR JOBBER CANNOT SUPPLY YOU—WRITE FOR INFORMATION

C. H. DOCKSON CO., 2885 E. GRAND BLVD. DETROIT, MICHIGAN

ties of this school, which draws students from within a radius of several hundred miles of Philadelphia, has been increased to include equipment for 9 arc-welding operators, 8 oxyacetylene outfits and seven welding compartments. Among the students are a number from the Rehabilitation Bureau of the state of Pennsylvania. William Rice, proprietor, reports that the number of students enrolled is approximately double that of a year ago.

Recently fumes from a container of naphtha were ignited by sparks from an arc-welding outfit in the shop of Mike Melzer at 3719 W. Third St., Dayton, O. The resulting explosion and fire left Mike without anything, and the necessity of "starting all over again." A short while previous to the fire, Melzer had branched out into the building of custom trailers and at the time his shop burned he had just completed three house trailers, all of which were destroyed. Undaunted, Melzer has built anew in bigger and better style.

Individual welding instruction is being offered at Lou's Welding Shop, 1601 South 60th Court, Cicero, Ill., by the manager, Louis Wolff. Instruction is given in various metals and alloys, including mild steel, welding copper with the metallic arc and carbon arc, monel, stainless steels, Herculoy, brass, aluminum, abrasive steels, nickel-clad steel, and pure nickel, also instruction in oxyacetylene welding and cutting. In addition to conducting a job welding shop and school, Mr. Wolff also builds high-speed portable arc-welding units.

Farmers of upper eastern Tennessee and the extreme western section of North Carolina are beginning to realize the value of having their tractors and other agricultural machinery welded "on the spot," says Mayland H. Muse, proprietor of the Southern Welding Co., 415 W. Market St., Johnson City, Tenn. Mr. Muse provides this portable service at a rate of $2 per man-hour, plus a transportation charge of 10 cents a mile, and says it is fast developing into an important part of his business.

The Atlas Boiler & Welding Works, 205 S. Ninth St., Louisville, Ky., had 5 ft. of water inside their shop during the recent flood, with damage estimated at $1,000. During the flood the shop supplied gas-engine-driven welders to furnish electric current for the Stewart Dry Goods Co., department store at Fourth and Walnut Streets, and for charging batteries. Atlas has just completed the installation of a 1,000-hp. central heating plant at the University of Kentucky, Lexington, Ky.

An Orton crawler crane with an all-welded boom, about 50 ft. long, being used by the Meizlish Co. in Dayton, O., recently was in an accident in which the boom was bent around the A-frame of the crane. An inspection revealed that no welds were broken. The twisted and bent members were cut out and replacements were welded in. The boom was of the lattice type, the section at the center being about 28x36 in. The corner angles were 3x3x5/16 in., and $\frac{1}{2}$x$\frac{3}{8}$-in. lattice bars were used.

Bids were recently taken by the U. S. Army Engineers at Omaha, Nebr., for the construction of two all-welded steel mattress barges. These barges will be 100 ft. long, 32 ft. wide and 4 ft. deep and will require about 200 tons of steel plates and shapes. Delivery is to be made within 90 days. The carriers will be of the flush-deck type and will permit the construction of mattresses for use in bank protection on the deck, after which they are slid onto the bank to prevent erosion.

The Inland Waterways Corp., known also as the Federal Barge Line, is reported to be in the market for one or two all-steel derrick barges. Bids will be opened at Washington for the construction of these vessels, which will be

It's Almost Magic!

when you realize the many uses and the service of COLMONOY NO. 6!

The same rod may be used as a metallic electrode and deposited with the electric arc, or it may be used to form a hard facing with the oxyacetylene flame, on . . .

STEEL—CAST IRON—COPPER—BRASS—BRONZE—MONEL—and the overlay or hard facing will resist the corrosive action of sulphuric, hydrochloric, acetic or other acids, and alkali solutions, as well as resist abrasion.

COLMONOY NO. 6 may be ground to a smooth, high-polished surface which will remain smooth in any service—and it never checks or cracks, regardless of the type of application or length of time in use.

Seems like magic, but you can prove it—write for these booklets, and tell us your proposed use—we will help solve your problem.

Send for these **FREE BOOKLETS**

COLMONOY, INC.
LOS NIETOS CALIFORNIA

COLMONOY

96 ft. long, 36 ft. wide and 9 ft. deep. Each is to be equipped with a structural-steel boom, 50 ft. long, with a capacity of 10 tons in a 30-ft. radius. Approximately 150 tons of steel plates and shapes will be required in the construction.

The John I. Hay Co., of Chicago, has awarded a contract for six steel combination barges to the Ingalls Iron Works Co., of Birmingham, Ala. These barges, of all-welded construction, are for the movement of sand and gravel or petroleum products. They will be 185 ft. long, 35 ft. wide and 9 ft. deep, and will have a capacity of 7,500 barrels of gasoline and a deck load of 1,000 tons each. Six bids were received for their construction, and the figures were exceptionally close.

According to Colonel Paul S. Reinecke, in charge of the U. S. Army Engineers of the St. Louis district, bids will be opened in that city on March 30 for the construction and delivery of a fleet of oil barges. These steel barges, for which bids are being asked in quantities of 5, 6, 7 and 8, will each be 152 ft. long, 34 ft. wide and 5 ft. deep. Approximately 175 tons of steel plates and shapes will be required for the construction of each of these vessels.

One Bead may *look* like another But there's a BIG difference

When you lay down a bead of **Penn Bronze** you know that not only is it a good looking bead . . . you *know* it will be dense, strong. Thousands of welders know and use **Penn Bronze** for reliable results.

Double Deoxidation—an exclusive feature found only in Titan Welding Alloys,* provides protection against the formation of gases and harmful oxides in bronze welding. Thus you are assured of welds that possess greater strength combined with greater ductility.

(Trade Mark Registered)

Additional features that cause Titan Welding Alloys to be preferred by welders everywhere include: Uniform Tinning, Low Melting, Low Fuming, and Corrosion Resistance.

Samples of our Penn Bronze, Titan Bronze, Titan Brazing Bronze and Titan Manganese Bronze Alloys gladly sent on request.

*U. S. Patent No. 2,022,439

Titan Metal Manufacturing Co.

Bellefonte, Pennsylvania

J. B. Bemmen, manager of the Michigan Welding Co., 341 Grandville Ave., Grand Rapids, Mich., announces that his company has developed a new technique in welding dies for small automobile parts. The company specializes in welding lead-lined plating tanks, and has purchased a new 300-ampere welding machine. Recently the company fulfilled a contract for welding the steel framework of a new building of the Michigan Bumper Co.

It is reported that the Reliable Welding Co., 647 South 15th St., Louisville, Ky., suffered a large loss to both equipment and damage to the shop in the four or five feet of water during the recent flood. The shop, managed by D. M. Hunt, was in a district that was badly flooded and which suffered big losses. Prior to the flood, the shop took out a permit to build a new shop at Fifteenth and Magazine Sts., which is near the present shop's site.

Bids were recently opened by the U. S. Army Engineers at Vicksburg, Miss., for the construction and delivery afloat of one derrick barge and derrick of the 50-ton type. Seven bids were received and it is understood that the St. Louis Ship Building & Steel Co., of St. Louis, with $31,600, and the Treadwell Construction Co., of Midland, Pa., with $32,995, were the low bidders. Awards are expected to be made shortly.

A huge boiler now under construction in the plant of the Elliott Co., Jeannette, Pa., was recently inspected by George E. Berry, of the U. S. Bureau of Marine Inspection and Navigation. It is known as an 80,000-lb. water marine-type deaerating heater and is being built for the sea-going hopper dredge *Goethals*. It is of the upright type, about 15 ft. high, with a diameter of 5 ft., and is of all-welded construction.

Bids on 10 oil tanks is being asked for by the Penola Co., of Pittsburgh, Pa., subsidiary of the Standard Oil Co. of New Jersey. The tanks vary in diameters from 14 to 35 ft. and from 30 to 40 ft. in height. Bids are being asked on both welded as well as riveted equipment. The order involves approximately 200 tons of plates and shapes and it is expected the business will be placed momentarily.

An expansion program which will result in much employment for welders has been announced by North American Aviation, Inc., of Inglewood, Calif. Application has been filed for a permit to construct a $225,000 addition to its factory at 5701 Imperial Highway. The building will be 300x450 ft., much of which will be of welded steel construction.

The United Concrete & Steel Pipe Co.'s plant near Baldwin Park, Calif., was recently enlarged to afford additional facilities for handling a contract for the production of a large quantity of welded reinforced-concrete pipe for the Los Angeles Metropolitan Water District. A large force of welders are employed at the plant.

W. F. Perkins has been placed in complete charge of the Western Gas Division of the Koppers Co., at Fort Wayne, Ind. R. A. Wickes will continue as general manager of the division. Mr. Perkins is also vice-president in charge of the American Hammered Piston Ring and Bartlett Hayward Divisions of the Koppers Co.

V. J. Harder, of The Harder Welding Co., 240 Commerce Ave., Grand Rapids, Mich., sold his business on March 1 to Aubry Clifton and H. Dale Hoffmeyer, who were formerly associated with Michigan Gases, Inc. The new owners have constructed a portable welder, and have installed a unit for metal spraying.

The barge-erecting shop in the yards of the Dravo Corp., of Pittsburgh, Pa., is virtually completed and already three all-welded steel coal barges, on an order of ten for the Hillman Transportation Co., of Pittsburgh, have passed through the new shop, which is entirely under cover.

G. J. Green, vice-president of the Pittsburgh Welding Corp., Pittsburgh, Pa., reports that members of his concern are now engaged in work on four steel railroad bridges in various parts of Texas. The work has been going on for about one month, and is now half finished.

A session on "Accident Prevention Equipment," with T. A. Willson, of Willson Products, Inc., as chairman, will be held at 2:15 p.m. on Tuesday, April 13, during the Eighth Annual Convention of the Greater New York Safety Council, at the Astor Hotel, New York.

Western Kansas is to have a new refinery. The Shallow Water Refining Co. are building a new plant near the oil pool of that name in Scott County, near Scott City. The Winkler-Koch Engineering Co., of Wichita, Kansas, are supervising the construction.

Two dump scows from the fleet of the Pittsburgh Plate Glass Co., used for dredging operations in the Pittsburgh harbor, were recently taken to the docks of Crookshank & Sons for repairs. Most of the work requires are welding.

Work for many welders will be provided in the construction of a new $600,000 natural-gasoline plant at Lin-Co., which project is just getting under way. The plant is to be in the Rodessa field, of Cass County.

A big order for 16-gauge stainless-steel acetic-acid and chlorine-gas tanks for the Union Bleachery Co., Greenville, S. C., and the Southern Bleachery at Taylors, S. C., has been received by the Greenville Welding Works of Greenville, S. C.

The Federal Supply & Machine Co., Winfield, Kan., recently added arc-welding equipment to complete their service to the oilfield and industrial trade in their territory. Their new spacious shop den, Texas, by the Phillips Petroleum is considered one of the best in the state.

Ed's Weld Shop, at 2922 W. Third Street, Dayton, O., is making a specialty of the construction of auto trailer hook-up bars in anticipation of the spring demand for them, according to Ed Smoth, proprietor.

The Equipment Reclamation Works of Chicago, who designed and built the

OKOCORD

Extra Flexible

WELDING CABLE

● **The ideal welding cable must be flexible, must stand abuse and be perfectly insulated.**

Okocord Welding Cable embodies these three attributes. It is extremely flexible, because the conductor is made of a great many fine copper wires. It withstands mechanical abuse because it is made with a jacket of tough, tire-tread type of 60% rubber. It has perfect insulation because it is insulated by The Okonite Company — an acknowledged leader in the insulation field since 1878.

For long trouble-free service, use Okocord Welding Cable.

THE OKONITE COMPANY

Founded 1878

and

HAZARD INSULATED WIRE WORKS DIVISION

THE OKONITE-CALLENDER CABLE COMPANY, INC.

EXECUTIVE OFFICE: PASSAIC, N. J.

New York, Boston, Chicago, Detroit, Philadelphia, Pittsburgh, Washington, San Francisco, Los Angeles, Seattle, Buffalo, Dallas, Atlanta

Factories: Passaic, N. J., Wilkes-Barre, Pa., Paterson, N. J.

large crusher head described in the December, 1936, issue of *The Welding Engineer*, is moving on April 1 from their present location at 530 West 79th St., to larger quarters at 75th and Green Streets.

The State Metal School, 481 Ellicott St., Buffalo, N. Y., have opened a branch school in Niagara Falls, at 35 W. Niagara St. This branch has already increased its student list to 33.

Spencer Trailers, built at Augusta, Kan., are seeing the world. Several were recently shipped to South America. The company reports a splendid business and are rushed keeping up with orders.

Ritchie & Co., Long Beach, Calif., specializing in boiler and pressure-vessel work, recently took over the shop of Val's Welding Works, at 2609 Cherry Ave.

Wing's Boiler & Welding Shop near Haven, Kan., burned to the ground on Feb. 28. All equipment was lost.

· CLASSIFIED ADS ·

Help Wanted—75c per line, minimum 4 lines. Jobs Wanted—4 lines free. Other Ads—$1.00 per line, minimum 4 lines. Count 8 words to line. Add 6 words for keyed address.

FOR SALE

Fly Ball Governors—Adapted to all makes of auto engines; belt driven, flat or V. Price, $6.50 prepaid. Ball bearing, $2.00 additional. Satisfaction guaranteed. In ordering state style of belt. Wm. Alber, Beatrice, Nebr.

WELDER FOR SALE
200-Amp. G-E Arc Welding Machine. Price $260.00.
The Norton-Broadway Machinery Co., Cincinnati, Ohio

Bargains—Demonstrator Arc Welders. Gasoline and electric drive. 30 days' trial. Easy terms if desired. Write Ken's Exchange, Box U-371, Troy, Ohio.

BUSINESS FOR SALE

Welding and Auto-Radiator Repair Shop—Out salvage. Arkansas location. Good going town of 7,000 population. Will sell at a bargain for cash. Address Mar-2, The Welding Engineer.

MISCELLANEOUS

Arc Welders—Build Your Own, saving $300 to $500. Complete instructions furnished. Easy pays-its-own-way terms. Investigate before you buy any welder. Hobart Welder Sales, Box U-462, Troy, Ohio.

ROL-MAN
A TRUE MANGANESE STEEL
MANGANESE STEEL WELDING RODS
The Original Manganese Steel Rod
Hard . . Tough . . Wear Resistant
MANGANESE STEEL FORGE CO., BUTLER & RICHMOND STS., PHILA., PA.

Greater Profits This Spring Than Ever Before

You can make your welding shop profits exceed your greatest hopes for 1937 if you will use NEW PROCESS high carbon abrasion resisting steel reclaiming units for plow shares, planter runners, cultivator shovels, sweeps, and other farm implements.

Clear simple instructions easily followed insure satisfactory results.

LARGEST MANUFACTURER OF A COMPLETE LINE OF RECLAIMING UNITS FOR ALL FARM TILLAGE TOOLS.

U. S. Patent 2,013,818—2,051,234—Canadian Patent Granted

ELECTRIC WELDED

Write for New 36 Page Catalogue

NEW PROCESS PLOW WELDING CO.
PERRY IOWA

Manufacturers of Cultivator Shovels and Sweeps

HELP WANTED

Salesmen for Arc-Welding Machines and Electrodes—Manufacturer of D.C., A.C., and Gas Drive Welders, also complete line of shielded and stainless electrodes, has openings for salesmen in Midwestern and Eastern territories. Attractive proposition to men of proven ability on salary, expense and liberal bonus or straight commission basis. Address Mar-6, The Welding Engineer.

Sales and Service Man—Responsible manufacturer of welding and cutting gases has positions at several locations for capable men qualified to solve practical welding and cutting problems in the field. State in detail your experience, age, salary expected, and nature of employment during last five years. Address Mar-7, The Welding Engineer.

Welding Demonstrator-Salesman — By manufacturer of heavy-coated electrodes. Must have supervisory experience in fabrication and field work. Sales experience desirable but not essential. Give education and experience in detail, also references and salary expected. Address Mar-4, The Welding Enginer.

Demonstrator—Man thoroughly experienced in arc-welded fabrication, to demonstrate and sell heavy-coated electrodes for well-known manufacturer. Excellent opportunity. Give experience in detail and salary expected. Address Mar-5, The Welding Enginer.

Repairman—Experienced on all makes of oxyacetylene apparatus. Also to demonstrate and sell. State experience, references and salary desired. Address Mar-3, The Welding Engineer.

POSITIONS WANTED

Electrical Engineer — Experienced on spot welders, arc welders, controls and allied electrical equipment, with thorough experience in design, manufacture, costs and sales. Desires position with responsible welder manufacturer or will design and market profitable line for a firm willing to expand. Salary or percentage. Will consider establishing Canada or Mexico branch factory. Address F-1, The Welding Engineer.

Welder and Mechanic—4 months' school training in arc and acetylene welding; 2 months' practical experience. Experienced mechanic on trucks, tractors and farm machinery. Age 25. Howard Buzzell, 404 E. Juneau Ave., Milwaukee, Wis.

Arc and Acetylene Welder—3 years' experience in maintenance and production welding. Interested in structural or tank welding. Stanley Gorsiski, 300 Goold St., Racine, Wis.

Combination Welder—17 years' experience in gas and arc welding and general blacksmithing. Now in charge of general repair shop. George Petrie, Ionia, Mich.

Welding Engineer—Expert on fabrication. Able to design and build welding machinery for intricate work. Address Mar-1, The Welding Engineer.

MEMBER AUDIT BUREAU OF CIRCULATIONS

THE WELDING ENGINEER

Vol. 22, No. 4 APRIL, 1937

MAIN CONTENTS OF THIS ISSUE

STRUCTURAL STEEL

All-Welded Shop Constructed for Barge Assembly (Sykes) 17
Arc Welding in Building Construction (Jennings) 19

FLAME CUTTING

Milling Machine Also Serves as Shape Cutter (Smith) 22

FREIGHT CARS

All-Welded Automobile Freight Cars (Nystrom) 24

Editorial 15
Welded Battleships and a Submarine for U. S. Navy 18
Welded Elevated Tank Built for Elyria, Ohio 18
Every Building Code Should Permit Welding 18
Welding Used on 30 New Barges 21
Purchasing Agents to Get Eyeful of Welding 21
Census Data on Oxygen and Acetylene 23
Welded Craft for Service on Western Rivers 23
First Orders for All-Welded Hot-Blast Stoves 28
Welding on New York's New Hudson Tunnel 28
Program Announced for Wisconsin Conference 29
Transport Plane Employs Arc-Welded Construction 29
High Interest Shown at Kansas Conference 29
Welding News in Pictures 30
Shell Lays 312 Miles of New Pipeline 32
Heat-Treating of Metal Surfaces With the Arc 33
Alloys for Electrodes for Use in Resistance Welding 33
Large Butt-Welded Stacks Under Erection 34
Adjustable Welding Table With Extension 34
Death Takes H. R. Hurlbut 34
Pittsburgh Engineers Take Course in Welding 34
International Body Asked to Devise Rules for Welders 34
Welded Ship Tonnage Shows Increase 35
Chattanooga Conference Program Announced 35
Meetings 36
Coming Events 36
Preheating and Welding Cast-Iron Parts 37
Repairs Differential and Flywheel Gears 37
What's New in Equipment and Supplies 38
Trade Literature 39
Commercial News 40
Notes From the Field 42

G. H. MACKENZIE, *President and Treasurer*
F. L. SPANGLER, *Editor* L. C. MONROE, *Advertising Manager*

Representatives

EASTERN: T. E. Depew, American Circle Bldg., New York, N. Y. Tel. Columbus 5-7843. PACIFIC COAST: W. R. McIntyre, Architects Building, Los Angeles, Calif. Tel. Michigan 2561.

Subscription, payable in advance: United States and possessions, and Canada, $3 a year; Foreign Countries, $4 a year; Single copy, domestic, 25 cents; Single copy, foreign, 35 cents. Entered as second-class matter January 20, 1916, at the postoffice at Chicago, Illinois, under the act of March 3, 1879.

FOREIGN REPRESENTATIVES: AUSTRALIA and NEW ZEALAND—R. Hill, Matlock House, Davenport, Auckland, New Zealand; GREAT BRITAIN—A. D. Baynes, 6, Mordaunt House, Larkhall, Clapham, London, S. W. 8, England; SOUTH AFRICA—J. W. Arnison, 35a Victoria Avenue, Benoni, Transvaal, South Africa; JAPAN—Maruzen Company, Ltd., 6, Nihonbashi, Tori-Nichome, Tokyo, Japan; U. S. S. R.—Mesdunarodnaja Kniga, Kusnezkij Most 18, Moscow, U. S. S. R.

Published on the 15th of each month by the Welding Engineer Publishing Company, 608 S. Dearborn St., Chicago, Ill. Telephone Webster 7134.

When You
LIGHT UP
A REGO GX

UNIVERSAL WELDING TORCH
THE TORCH OF A THOUSAND PROFIT PURPOSES

WRITE TODAY FOR 1937 CATALOG R—120

The BASTIAN-BLESSING Company
278 East Ontario Street Chicago, Illinois

Pioneers in Equipment for Using and Controlling High Pressure Gases.

CHECK U

THESE *EXCLUSI* GX FEATURES

CHECK—One torch for all ... ing within the limits of the pr...

CHECK—Operates on oxyge... acetylene pressures as low a... lbs.

CHECK—Uses equal volume... oxygen and acetylene.

CHECK—Tips have "d ou... range" capacity.

CHECK—No screws, tubes o... dered joints.

CHECK—No gas turbulence ... diffused welding flames.

CHECK—The lightest wei... complete range torch.

CHECK—No time limit on g... antee covering workmanship ... material.

Light up a GX torch using you... called *empty* oxygen and ace... cylinders and watch Real Eco... Go On.

INDEX TO ADVERTISERS

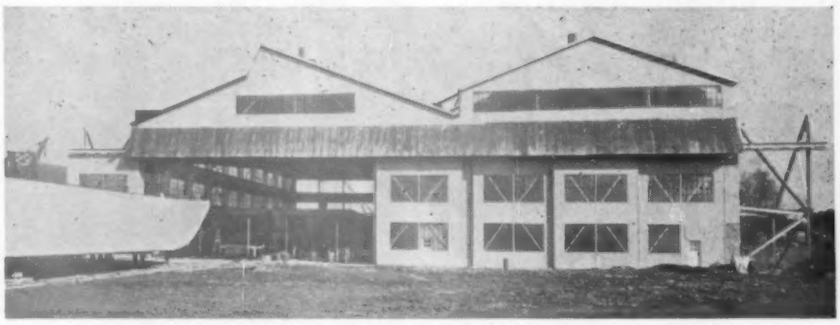
	Page
A	
Adams Co., J. D.	Inside Front Cover
Aladdin Rod and Flux Mfg. Co.	58
American Agile Corp.	57
American Arc Welders	56
American Brass Co.	41
American Welding Society	43
Anti-Borax Compound Co.	58
Arcos Corp.	58
B	
Bastian-Blessing Co., The	6
C	
Carter Hotel	54
Central Steel and Wire Co.	Inside Back Cover
Chicago Hardware Foundry Co.	52
Chicago Steel and Wire Co.	53
Classified Ads	50 and 51
Colmonoy, Inc.	49
D	
Douglass Pipe Machine Co.	58
Duraweld Metal Products Corp.	58
E	
Eisler Engineering Co.	58
Electric Hose and Rubber Co.	57
G	
General Electric Co.	13
H	
Handy & Harman	45
Harnischfeger Corp.	10
Harris Calorific Co., The	Back Cover
Hobart Brothers	3 and 51
I	
Ideal Face Shield Co.	58
Imperial Brass Mfg. Co.	52
J	
Jackson Electrode Holder Co.	Inside Back Cover
L	
Lincoln Electric Co., The	7 and 51
M	
Manganese Steel Forge Co.	46
Metal & Thermit Corp.	14
Metal Bond Mfg. Co.	56
Milburn Co., The Alexander	56
N	
National Carbide Corp.	53
New Process Plow Welding Co.	61
Northeast Metals Co.	58
O	
Ohmite Mfg. Co.	54
Okonite Co., The	48
P	
Pierce Governor Co.	44
Pratt & Whitney Division	11
R	
Revere Copper and Brass, Inc.	12
Roebling's Sons Co., J. A.	4
Ryerson & Son, Inc., Jos. T.	47
S	
Safety Gas Lighter Co.	56
Smith & Co., Gordon	54
South Side Welding School	61
Steel Sales Corp.	52
Stoody Co.	55
Stulz-Sickles Co.	56
T	
Taylor-Wharton Iron and Steel Co.	53
Titan Metal Mfg. Co.	16
Torchweld Equipment Co.	54
U	
Una Welding, Inc.	9
V	
Victor Equipment	8
W	
Wilco Company	56

The Welding Engineer

VOLUME XXII | APRIL, 1937 | NUMBER 4

All-Welded Shop *Constructed for* Barge Assembly . . .

By EDWARD H. SYKES
Pittsburgh Correspondent,
The Welding Engineer



Welded Barges Are Made by Production-Line Methods in This Shop Whose Framework Is All-Welded.

A LARGE welding shop, designed for the building of all-welded barges by production-line methods, was recently completed by the Dravo Corp., Neville Island, near Pittsburgh, Pa. The building itself has an all-welded framework, with steel sash covering most of the wall area.

The new shop is a unique development in shipbuilding facilities, in that it is entirely enclosed. While some covered marine ways are in existence in this country, the housing of construction ways in an enclosed, heated building is entirely new. The shop will free production methods from interruption by bad weather, and will materially simplify problems of welding during periods of extremely low temperatures.

Two bays have been provided. One, 63 ft. by 207 ft. 6 in., provides a shop for preliminary assemblies and storage of fabricated sections, while the other, 91 ft. 6 in. by 207 ft. 6 in., provides space for the complete erection and welding of three barges by production-line methods, which entail the shifting of barges laterally from one position to another as each stage in the construction is completed.

Following preliminary assembly in the first bay, the middle body of the barge is tacked together in the first position on permanent skids which eliminate wooden blocking. After this, the barge is moved to the second position on groups of transfer cars provided with hydraulic jacks and running in grooved tracks.

At the second position, the rake ends are added and the vessels are completely tacked, preliminary to moving to the third position, where the barge is welded and tested. Because of the fact that as much as 300,000 gallons of water may be needed to test an average oil barge, the new building is equipped with complete facilities for providing water, and with sewers for removing water. An electric distribution system is also pro-

Interior View of Shop Showing Barges Under Construction.

vided for the operation of welding equipment at any convenient point.

Following completion of the barge, suitably arranged transfer cars and tracks make it possible to move the barge longitudinally out of the assembly shop and thereafter sidewise to the ways for launching.

The entire downstream end of the building is provided with sliding doors of the airplane-hangar type. These are suspended from an overhead track so that any of the seven doors can be operated independently or the entire end of the building can be thrown open by moving all the doors to extensions of the overhead track at either side of the building. The doors, which cover the 154-ft. 6-in. end of the structure, are 28 ft. high and 22 ft. wide. The movement of the barges both inside and outside of the plant is done through the use of winches operating endless cables.

Facilities for barge movement made necessary the installation of 2,200 ft. of track, in addition to a large number of skids to replace wooden blocking within the plant.

Office space and rooms for the boiler and transformers are located in a lean-to running the full length of the building, on the river side.

Welded Battleships and a Submarine for U. S. Navy

Arc welding will be used extensively for the first time by the U. S. Navy in capital-ship construction when it builds its new twin 35,000-ton battleships, according to reports from Washington.

It is also of interest that the U. S. Navy has under construction a submarine at the Mare Island Navy Yard at Vallejo, Calif., which is said to be the first submarine that will employ all-welded construction.

Navy officers expect welding to save as much as 1,000 tons in weight in each of the two new battleships, which affords that much extra margin for armor, armament and speed. Welding will also be applied to the outer armor plates. Rivets, it is reported, will be used only at joints subjected to extraordinary stress.

Welded Elevated Tank Built for Elyria, Ohio

A large welded water tank was completed recently for the city of Elyria, O., by the Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.

The chief feature of the tank is its mushroom shape, as compared to the conventional, cylindrical water tank. The technical name for tanks of the mushroom type is "toroidal bottom," which means that the bottom is partly suspended and supported by beams. The purpose of the new shape is to give the largest possible capacity with the lowest over-all depth. Because of the shallowness of the water, which will be only 25 ft. deep in the tank, the water may always be delivered against a sufficient head in the tank, rather than against the variable pressure obtaining in a system having no such storage as a balance. The cost of operating pumps is thus materially reduced.

The tank is of 1,000,000 gallons capacity, and has a diameter of 84 ft. 3 in. It rests upon a supporting tower consisting of an inner and an outer circle of steel columns. The riser pipe, extending

Tower With Welded Roof and Bottom.

from the bottom of the tank and connecting it with the underground main, is 8 ft. in diameter.

The entire mushroom bottom and the roof of the tank are of 9/16-in. plate, butt welded. Twenty welding operators worked on the job, which took about three months to complete.

Every Building Code Should Permit Welding

By H. S. CARD
Development Director, N. E. M. A., Electric Welding Section

In view of the cheerful forecasts about what is going to happen in the form of new construction, some attention should be given immediately to the building codes which makes no provision for the use of welding in building construction. Here is a process that frequently offers marked advantages to the builder, but in most cities is legislated against simply by not being mentioned in regulations which govern the erection of public and private buildings, regulations which were drafted before welding was successfully applied in this field.

A curious situation has developed. Practically all large fabricators and erectors of structural steel have welding equipment, and practically all of them do some welding in the assembly of structures that are subject to more severe loadings than will ever be encountered in buildings—structures that are not subject to regulation. Yet with all their knowledge of welding, with all their experience in safe procedures and inspection, the opportunity to apply the process in building work is nil, not because it is forbidden, but because it is not permitted.

The only rational basis for deliberately excluding a process under a building-code regulation is the matter of safety—and the safety of welded-building construction has been thoroughly and completely established. As a preliminary step in 1927, 42 welding operators in as many widely separated shops were asked to pass a uniform qualification test. Then they were allowed to weld up a set of typical structural connections. The uniformity with which these sample joints met the computed requirements for strength and safety was amazing even to the most ardent proponents of structural welding. Thus it was established that reliable workmanship can be predetermined by means of operator qualification tests, and that certain design values for welds can safely be accepted. This was the work of the Structural Welding Committee of the American Welding Society, whose report, published in 1931, was hailed as the Magna Carta of welding.

So much for the proof that it can be done. The next question was how to do it—safely. Again the American Welding Society produced a complete answer, in the form of a model code for the use of welding in building construction, the safeguards in which are more inclusive and more exacting than any board of building inspectors could devise. It is the work of welding experts who, in drafting the code, took every precaution to prevent unsafe design, practices or workmanship. Yet it is an entirely fair and workable code.

The "proof of the pudding" is that in twenty-four states the A.W.S. code, or codes which are substantially the same, was adopted locally—and that within two years over one hundred structures had been welded. And there have been no failures of welded buildings.

All this is history—but it needs this reviewing because construction activities are on the upgrade and the way should be opened for welding to be used where it is wanted. The NEMA Welding Section has been asked to cooperate in the revision of several municipal building codes; but it is not logical to allow welding in only a few cities. This permission ought to be universal. The hard work of making it perfectly safe has been thoroughly done. All that remains is the routine work of official action.

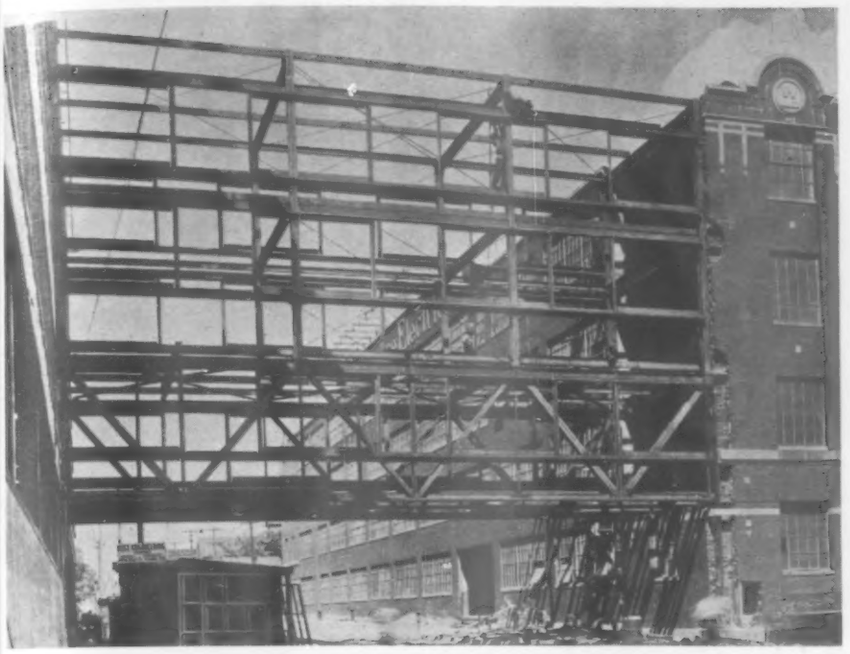


Fig. 1. Welded Bridge Spanning a Street Between Two Buildings.

Arc Welding in Building Construction . .

By CHAS. H. JENNINGS
Westinghouse Electric & Manufacturing Co.

TWO all-welded buildings, recently fabricated for the Westinghouse Electric & Manufacturing Co., are described. These buildings incorporate the latest trends in welding design and practice, and illustrate the application of welding to multiple-story buildings and single-story extensions to old buildings.

WELDING as a method of fabricating buildings has long outgrown the experimental stage and is now recognized by leading engineers as being equal and in many cases superior to riveting. The first arc-welded building was constructed about 1926 and the results, although entirely satisfactory from the standpoint of strength, were not all that was desired from the standpoint of economics. Lack of experience in design and erection problems, combined with the fact that welding was being applied to a new field, probably accounted for many of the stumbling blocks encountered.

Since the erection of its first all-welded building in 1926, the Westinghouse Electric & Manufacturing Co. has constructed 30 all-welded structures and bridges, comprising a total of approximately 12,000 tons of arc-welded steel. The experience obtained during these 11 years of welded steel construction is reflected in the design and welding of the more recent buildings. Joints have been simplified, beam designs have been improved, erection problems have been reduced and welding processes have been improved. Throughout each design every effort was made to eliminate unnecessary weight and to keep the amount of welding to the minimum, consistent with the loads transmitted. As a result, the most recent buildings erected have proved to be superior to the conventional riveted design in every respect.

Probably the largest arc-welded building to be constructed in 1936 was a 5-story office and warehouse building built at Mansfield, O. This building is triangular in shape and the sides subtending the right angle are each 322 ft. long. Although the building contains only five stories, it is 102 ft. high, or equivalent to a 7-story building. The first two floors are 24 ft. high, the third and fourth floors 14 ft. high and the fifth floor 12 ft. high. Each floor contains 60,000 sq. ft. of floor space, or a total of 300,000 sq. ft. in all.

In addition to the building proper, a bridge was erected across the street to join the new building to the old warehouse building. This bridge structure is three stories high and its construction is shown in Fig. 1.

Flexible Connections Require Less Welding Than Fixed Connections

When designing a welded building, two types of beam-to-column connections can be used — fixed and flexible. Fixed beam-to-column connections make it possible to select beam sizes based on continuity and hence produce a structure with the minimum amount of

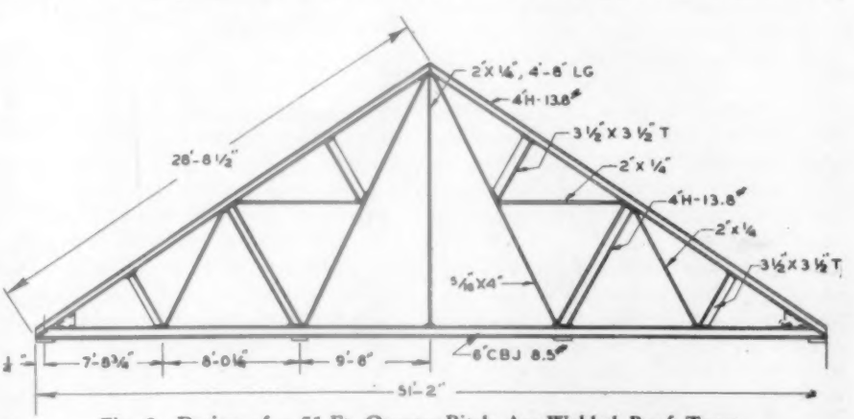


Fig. 2. Design of a 51-Ft. Quarter-Pitch Arc-Welded Roof Truss.

Fig. 3 (Left). Welders Fabricating a Roof Truss.

Fig. 4. Interior View of Arc-Welded Building Extension.

steel and the maximum amount of welding, while flexible beam-to-column connections produce a structure with the maximum amount of steel and the minimum amount of welding. The latter type of connection was employed in this building. High-speed coated-type electrodes were used in making all welds. The high strength and ductility of the welds made it possible to use a working stress of 14,000 lb. per sq. in. for fillet welds in place of the conventional working stress of 11,300 lb. per sq. in. for welds made with bare electrodes. Thus, the amount of welding was reduced about 24%.

5/16-In. Fillet Welds Generally Used

The major portion of all welds were 5/16-in. fillet welds. This size was used for two reasons: First, a great many connection angles had ⅜-in.-thick leg sections, and a 5/16-in. fillet weld is the most convenient size of weld to make on the toes of such an angle because of the fillet produced on the inner side of the angle leg by the rolling process. Second, a 5/16-in. fillet weld can be easily made with a single pass of a ¼-in. diameter electrode.

Approximately 45,500 ft. of shop welding and 12,000 ft. of field welding were required in the building. All the shop welding was done in the horizontal position, while only about 25% of the field welding was done in the vertical position. No overhead welding was used.

All shop welding was done with ¼-in. electrodes. The horizontal field welding was done with 3/16-in. electrodes and the vertical field welding with 5/32-in. electrodes. The application of coated electrodes of the type used made it possible to reduce the welding cost from 25% to 30% below the costs that would have been obtained had bare electrodes been used to make welds of the same size.

In order to increase the size of one of the large production aisles at the East Pittsburgh Works of the Westinghouse Electric & Manufacturing Co., a single-story arc-welded extension is being added to one of the existing buildings. This extension bridges an open space between two existing buildings and adds some 58,000 sq. ft. of floor space. Its total length is 907 ft. and its width varies from 52 to 98 ft.

Although this building is not outstanding because of its size, it illustrates the advantages of arc-welded construction, and incorporates a roof truss of truely an arc-welded design.

A typical design of the roof trusses used is shown in Fig. 2. These trusses are of the quarter-pitch type and are designed for a total load of 45 lb. per sq. ft. Light-section H-beams and steel straps are used for the main members in place of the conventional angle and tee sections.

Truss Design Simplifies Fabrication Problem

This design of truss lends itself readily to welding because it eliminates unnecessary preparation of the parts and reduces the amount of welding to the minimum. The ends of all members are prepared by straight cuts, thereby eliminating slotting and expensive fit-up. The fabrication problem was simple, and consisted of assembling the various parts in a jig welded to the floor, tack welding them together, and then removing the tack-welded structure from the jig and finishing the welding by positioning the structure as desired. Fig. 3 shows several welders working on a 51-ft. truss, the total weight of which is only 2,000 lb.

Forty-five 51-ft. trusses and seven 46-ft. trusses of the type shown in Fig. 4 are used in this building. In addition, seven 27-ft. trusses of the lean-to type are used. Fig. 4 is a photograph taken inside the building and affords an excellent view of a number of the 51-ft. trusses.

Welding Is Invaluable When Making Plant Extensions

The advantages of arc-welded construction in adding extensions to existing structures are clearly illustrated by Fig. 5. The span of the roof trusses of the new building did not correspond to the columns of one of the old buildings. This problem was easily solved by arc welding short cantilever members to

Fig. 5. Typical Welded Connection to a Column of an Old Building.

the old columns. A series of horizontal beams was arc welded on top of these cantilever members and the roof trusses located on the horizontal beams at the desired points. The use of arc welding for this application required the removal of only the minimum amount of brick from the wall of the existing building in order to attach the cantilever members to the old columns.

Arc welding also plays an important part in the design of the roof of this building. Steel deck plates are arc welded to the top and bottom sections of the trusses, as shown in Fig. 6. This steel deck is then covered with ½ in. of insulation on top of which 15-lb. asbestos felt is placed. The steel decks aid in stiffening the roof structure and eliminate the need of the usual cross bracing.

Sky lights are placed in the center sections of the trusses. These sky lights are also of novel design and consist simply of tie bars welded to the perlins (see Fig. 4). The glass is placed on the outstanding faces of the bars and sealed in place with Mastic cement.

All welding on this 225-ton structure was done with coated electrodes of the type used on the Mansfield office and warehouse building. The working stresses used in designing the welds were

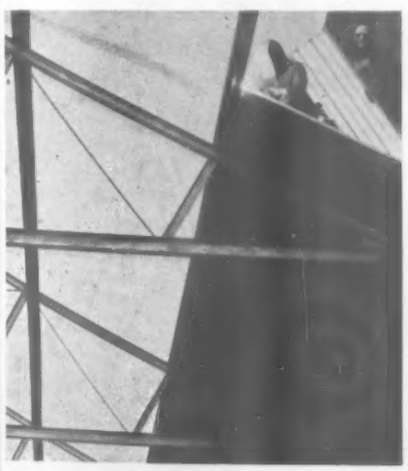


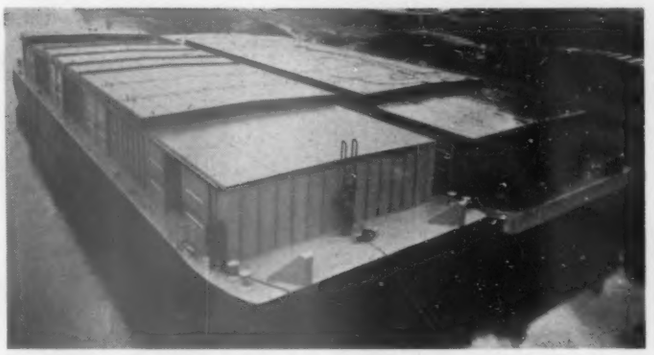
Fig. 6. Welding Deck Plating Onto the Roof of a Welded Building.

14,000 lb. per sq. in. for fillet welds and 16,000 lb. per sq. in. for butt welds. Because of the size of the parts welded and the nature of the joints, 3/16-in. electrodes were used in most cases.

Welding Used on 30 New Barges

Thirty huge barges, the construction of which entailed much welding, were completed recently for the Mississippi Valley Barge Line, of Cincinnati, O., by the American Bridge Co., Pittsburgh, Pa.

The barges, each of which is 132 ft. long and 35 ft. in beam, with 10 ft. hull depth, have many unusual features. There are no stanchions or supports of any kind inside the vessels, so that the cargo space in the hold is unobstructed. Loading is possible on three levels: hold, main deck and upper deck roof.



Barges Equipped With Rolling Hatch Covers and Floor Sections.

Cargo can go into the main deck through the customary sliding steel doors or through the rolling hatch covers, of which each barge has seven, each 10 ft. long and as wide as the deck house. The rolling feature of these covers allows a 40-ft. opening in the deck, for loading bulky cargo.

The main deck is a series of removable floor panels, supported by alternating rolling floor sections spanning the width of the deck house. These permit half the main deck to be opened, and make it possible to lower the cargo through the roof directly into the lower hold.

The rolling hatch covers, floor sections, and all of the superstructures of these barges are of welded construction.

Purchasing Agents to Get Eyeful of Welding

Delegates to the National Association of Purchasing Agents, an organization of industrial purchasing agents, which will hold its 1937 International Convention in Pittsburgh, Pa., May 24 to 27, will receive valuable first-hand information on welding when they make an official inspection of the Jones & Laughlin Steel Corp. mills at Pittsburgh and Aliquippa, Pa.

J & L have invited the agents to be their guests the afternoon of May 27, and will run special buses and trains from downtown Pittsburgh to the mills for the convenience of the delegates. More than 1,400 purchasing agents are expected to attend the convention, and most of them will make the trip through the mills.

Those delegates who make the tour of the Pittsburgh mills will see the first all-welded blooming mill manipulator ever manufactured, a huge all-welded machine weighing 1,575,000 lb., recently installed in the new J & L mill at Pittsburgh, and illustrated and described in the March, 1936, issue of *The Welding Engineer*.

The delegates who visit the J & L tubular mill in Aliquippa will see the manufacture of numerous kinds of welded pipe, including seamless and welded products for the oil industry, seamless power pipe, and standard pipe manufactured by butt and lap welding. Many very interesting operations are involved.

The first step in making butt-welded and lap-welded pipe, after obtaining the billets and rolling them into skelp, is to heat the metal to welding temperature. Skelp is thin slabs of metal, the width of which corresponds to the circumference of the pipe to be made. The thickness of the skelp equals the thickness of the pipe wall, and the sheared length of skelp equals the length of pipe desired.

In making butt-welded pipe, the skelp, having been heated to welding temperature, is drawn through a bell by means of tongs attached to an endless chain. The edges of the skelp are thus brought into contact with each other and subjected to enough pressure to weld them together, forming a rough, butt-welded pipe. The hot pipe then is drawn through the true size rolls, which adjust the size of the pipe, and is then delivered to the cooling conveyor. As the pipe advances, the rough ends are removed by hot saws.

In the manufacture of lap-welded pipe, the skelp is first heated independently to proper bending temperature. As the skelp leaves the furnace, the edges are beveled, or "scarfed," after which it is drawn through a bending die to form a rough tube with lapped edges. This tube is heated to welding temperature and is passed between two rolls and over a ball held in position by a mandrel. The rolling forces the scarfed edges of the tube together, and welds them, after which the tube is brought to size by rolling, and then straightened in crossrolls, emerging as finished lap-welded pipe.

More than $300,000 was spent recently for new machinery in these tubular mills, and the purchasing agents, especially those associated with welding supply and pipe manufacturers, will find many things of interest.

Milling Machine *also serves as* Shape Cutter . . .

By HAROLD E. SMITH

WHEN the Available Truck Co., of Chicago, needs torch-cut shapes, a few minutes' time is taken to convert one of their milling machines into a shape cutter, to be used either with or without a templet.

IN THE cutting of standard shapes from steel plates, the Available Truck Co., 2501 N. Elston Ave., Chicago, Ill., employs a Universal milling machine to which can be attached a cutting torch, the arrangement being such that either the torch or the work can be held stationary, or be made to move in a straight line by attachment to the milling-machine carriage.

Where other than straight-line cuts are made, a templet is used, this being made of steel plate, with one edge shaped like the line of the desired cut. The plate to be cut is laid on a base, under and attached to the templet. As the carriage moves in a straight line, the templet is guided by hand so that the cut corresponds to the shape of the templet.

Utility of Milling Machine Is Not Impaired

This device not only has taken care of all the torch cutting for this firm, but it has allowed them to increase this work without destroying the utility of the milling machine for its original purpose and without requiring additional space for a cutting machine in a shop where floor space is already at a premium.

The idea of the cutting device was that of Joseph Rath, foreman of the shop. Really it was not a new idea with him, but he had not had an opportunity to use it until a time came, two years ago, when the plant had an order which required the cutting of a large number of steel plates on an irregular curve. He made his idea known to Einar Comfield, chief engineer of the Available Truck Co., and then, with J. J. Cunningham asisting, went ahead and developed it.

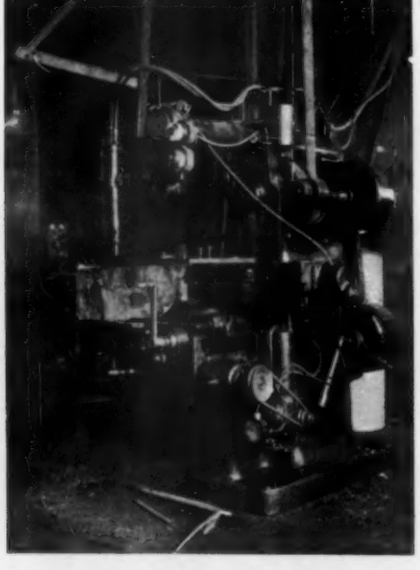
The only major change necessary, so far as the milling machine itself was concerned, was in the operation of the machine's carriage or moveable table. This consisted in installing an auxiliary motor to operate the carriage independently of the rest of the milling machine. The motor used for this purpose is attached to a platform bolted to the side of the milling-machine base. Through a clutch arrangement, which may be seen in the accompanying illustrations, the main motor of the milling-machine is thrown out of gear and the carriage of the machine operated by means of a belt and pulley rigged to the auxiliary motor.

Other additional attachments which were required to complete the conversion were two motor switches, a rheostat, the arm for holding the cutting head which is clamped to the arbor holder, and brackets for holding the hoses connecting the oxygen and acetylene tanks to the cutting head.

Cutting Table Holds Templet and Gives Protection Against Heat

The main part of the device, however, aside from the cutting head, is a steel table having the two-fold purpose of holding the templet and at the same time protecting the milling-machine carriage from the heat of cutting. The cutting table was made of 18 x 20-in. steel stock, ¾ in. thick. It has a tongue running lengthwise on the under side which fits into one of the grooves of the milling-machine carriage. This tongue is nearest to the side away from the cutting side, and it automatically sets the templet square with the milling-machine table, thereby preventing any lateral movement of the templet.

When necessary, because of the overhanging weight of stock that might have a tendency to tip the templet, the latter

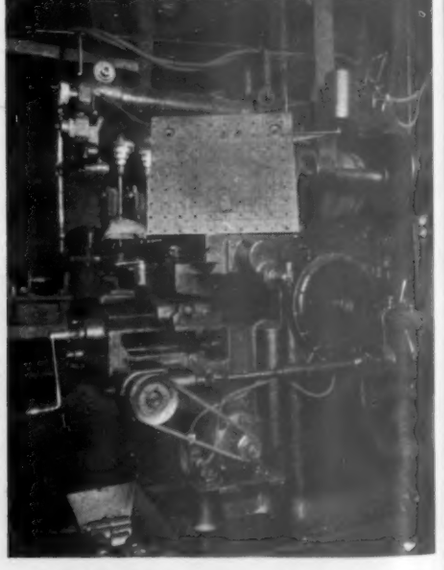


Mounting of Cutting Torch and Two Snap Switches.

(The torch and switches are easily removed so the milling machine can be used for its original purpose.)

Ready for Cutting With a Templet.

(The templet is in place below the torch, and a sheet-metal apron shields the machine bed from sparks from the cutting operation.)



View of Face of Cutting Table.

(The other side of the cutting table has a tongue to fit in a groove of the milling-machine carriage. The holes in the face of the table are to receive stops for locating the material to be cut. The special driving motor is mounted near the bottom of the base, and the speed rheostat is seen at the right.)

may be clamped to the milling-machine carriage by means of two bolts inserted through the cutting table and the tongue. To prevent interference with the work on the cutting table, the heads of these bolts are countersunk into the templet surface. An apron of sheet metal is attached to that side of the templet on which the cutting is done to prevent sparks from falling under the milling-machine carriage.

On the top surface of the templet or cutting table, 1-in. squares are marked off to facilitate rapid measurements when cutting is being done. In the center of alternate squares, holes were drilled and tapped ⅜-in.-24SAE. This makes it possible to set stops in order that the material may be held at any required angle, so that in conjunction with the flexibility of the machine carriage, which is capable of both a longitudinal and a lateral movement, almost any shape may be cut. Another aid to this wide range of movement is the ability of the carriage to be placed at any angle up to about 45°. This is accomplished by the cylindrical base of the milling-machine carriage being marked off in degrees.

The cutting head is held by a clamp, machined out for the purpose and welded to an extension arm which in turn is bolted to the arbor holder. At first an ordinary manual cutting torch was used. This later was replaced by a special Victor cutting head, designed purposely for torch-cutting machines, and this was found far better suited to the purpose.

The two electric switches are detachable so that they will not interfere with the use of the arbor head when the milling-machine is in its regular use. One of these switches operates the motor in its normal direction, while the other puts it into reverse. Mounted on the side of the milling-machine, near the regular motor and just above its drive shaft, is the rheostat, by means of which it is possible to handle the cutting at almost any speed desired by the operator to accomplish best results.

Templets Are Torch Cut and Finished by Hand

When the company received an order to make a large number of supports for tanks on trailers for a large oil-distributing concern, special templets were made for the purpose of speeding up the work and at the same time maintaining the same curve in each of the supports. The templets were cut with the torch and then finished off by hand. They were so constructed that when they were placed on the cutting table, the sheets of steel to be worked could be placed under the edge of the shaped part of the templet, the torch following along this line. In order that the

View of Two Templets.

(These templets are box affairs into which is laid the stock to be cut. During cutting, one end of the templet is moved so the curved edge is held against the torch, thereby cutting the stock to the same contour as the templet. The larger templet, about 4 ft. long, is used for cutting sections for the bottom of gasoline tanks.)

torch, which is given a straight-line movement by the carriage, may trace along the curved edge of the templet, the latter was fastened at one end only to the cutting table, and the other end moved to or from the torch by means of a handle (in this case, an old file) welded to the other end of the templet.

Torch Can Be Mounted on Carriage for Cutting Steel Bars

Among the many uses which have been found for the machine in this particular plant are the cutting of brackets for the fifth wheel of tractors, landing gears for trailers, and special jobs where the material is cut before being formed and welded to replace castings.

Another use found for this device is the making of short bars out of long ones. In this case, the cutting head is not attached to the arbor holder, but is fastened to the cutting table, and moves back and forth with it. A table 10 ft. long, consisting of two steel side bars connected by rollers at about 1-ft. intervals, is placed at right angles to the direction of the cutting head's movement and holds the material to be cut. This table is supported by two adjustable (portable, rather) stands made up of a steel rod attached to a base and with a bracket at the top into which the table sets. On every fourth roller is a collar which may be adjusted to act as a guide to the steel bars being cut.

It is not the contention of the builder of this converted torch cutting machine that it will do everything in the cutting line, but if it were necessary to make this adapted cutter more flexible—to cut circles, for instance—this easily could be done. A revolving turntable might be constructed and mounted upon the cutting table, the turntable being operated by a reducing gear for uniform speed. Some sort of self-centering device naturally would have to be used for a specific radius cut on any stock. Or, as another means of accomplishing this result, an arrangement might be made whereby the cutting head could be made to revolve about a central point on a graduated arm to give any desired radius within the capacity of the machine.

According to Mr. Rath, the machine used as a cutter has paid for itself many times, and the change from milling to torch cutting or back to milling is a matter of but a few minutes.

Census Data on Oxygen and Acetylene

Both the volume and the value of acetylene and oxygen made by concerns engaged primarily in the production of compressed and liquefied gases in the United States, showed a great increase in 1935 compared with 1933, and the 1935 acetylene output, in terms of cubic feet, topped the 1929 figure, according to compiled returns of the recent Biennial Census of Manufactures, conducted by the Bureau of Census, Department of Commerce. The figures for number of manufacturing establishments, volume of output, and value are as follows:

ACETYLENE

Year	No. of Establishments	Volume in 1000 Cu. Ft.	Value
1935	116	1,133,824	$14,747,854
1933	108	754,089	11,038,959
1929	104	969,534	16,553,763

OXYGEN

Year	No. of Establishments	Volume in 1000 Cu. Ft.	Value
1935	162	2,675,396*	$18,115,968
1933	160	1,821,880*	12,997,005
1929	178	3,140,095*	23,409,606

*Volume produced by the liquefaction process, in 1,000 cu. ft.: 1935, 2,584,251; 1933, 1,756,961; 1929, 2,816,641. Volume produced by the electrolytic process, in 1,000 cu. ft.: 1935, 91,145; 1933, 64,919; 1929, 323,454.

Welded Craft for Service on Western Rivers

Plans for the construction of a 90-ft. diesel towboat, expected to cost upwards of $75,000, and a 142-ft. steel oil barge to cost about $40,000, for use in the Willamette and Columbia Rivers are announced by R. L. Gault, manager of the Western Transportation Co., river shipping subsidiary of the Crown-Willamette Paper Co. Both boats will be built by the Albina Engine & Machine Works and both will be all-welded. The tug will be equipped with two 200-hp. motors and have a tall pilot house to permit an unobstructed view over the tops of barges. The barge will have a capacity of 6,000 barrels of oil and will be equipped with pumps capable of discharging the oil at the rate of 2,500 barrels an hour. Both crafts are to be delivered about August 1.

All-Welded Automo

By KARL T. NYSTROM
Chicago, Milwaukee, St. Paul & Pacific R. R. Shops, Milwaukee, Wis.

FOLLOWING the successful production of a group of all-welded passenger cars, described in the September, 1936, issue of The Welding Engineer, the Milwaukee Railroad has now completed the building of 1,000 automobile freight cars, described in this article. The road also has under construction a great many coal hopper cars, which will be described in a later article. All cars are entirely welded, and low-alloy, high-strength steel is used to reduce weight. Underframe and floor, side walls, ends, and roof are constructed separately on a mass-production basis, and then assembled to make the completed car.

ONE THOUSAND all-welded automobile cars were recently built by the Chicago, Milwaukee, St. Paul & Pacific Railroad in their Milwaukee shops. These consisted of 500 50-ton cars, 51 ft. 7⅝ in. over striking castings, and 500 40-ton cars, 41 ft. 7⅝ in. over striking castings. All-welded construction was employed, in conjunction with high-tensile-strength alloy steel.

Production Based on Unit Construction Principle

The cars were made on a production basis, employing the unit construction principle. Underframe, ends, sides and roof are assembled and welded completely as independent units, and subsequently united in their proper relation in an assembly line. These cars employ a combination of arc and resistance spot welding.

The resistance spot welding is accomplished by using an automatic single resistance spot welder, an indirect resistance spot welder and a series resistance spot welder. A single resistance spot welder is one employing two electrodes, one positive and one negative; usually one stationary electrode is below the work, and one movable electrode to which pressure is applied is on the top side.

In series and indirect resistance spot welders, the current passes through the work twice. The electrodes are arranged so that pressure is applied to both electrodes, pressing the work onto a copper backing. When proper pressure is built up, the current is automatically turned on and in the case of the series welder two spots occur where the electrodes contact the work. An indirect welder uses one electrode as a dummy; no spot develops at the dummy because of a large contact surface bringing the electrical resistance down below that required to heat the metal sufficient for welding.

Sides: The first step in the production of the sides is the series resistance welding of the side-sheet stiffeners to the side sheets. All side sheets are 9 ft. 7½ in. in height and 4 ft. 3⅞ in. to 4 ft. 11⅞ in. in width. The stiffeners are of 14-gauge material, formed to a trough section 1½ in. deep and 2¾ in. wide, with 1 in. flanges on each side of the trough to provide a surface for spot

The Two Halves of the Car End Are Placed in a Jig and Welded Together.

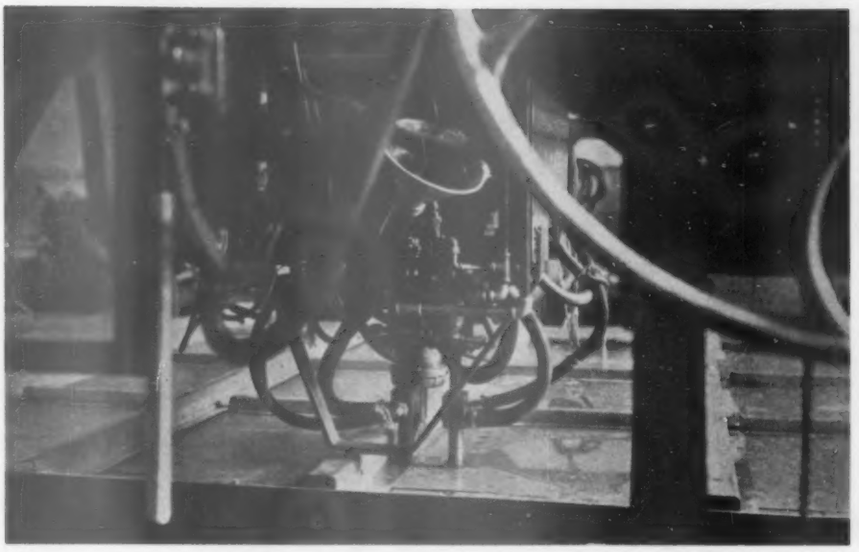
The Roof Is Formed of Pressed Pans Welded Together in a Jig, With Running Boards Welded in Place, Then a Ply-Wood Ceiling Applied.

welding. These stiffeners are on 26-in. centers so that there are three rows of stiffeners running longitudinally on the side of the car. The stiffeners are generally 2 ft. 3 in. long so that six stiffeners are required per sheet. A wooden templet is utilized in conjunction with special lay-out tables for the purpose of determining the position of and tacking stiffeners in place by arc welding. These parts are arranged in proper sequence and made ready for series welding. The series welder is equipped with a timing device which regulates the length of time between spots, welding time and pressure dwell. With this timing device it is possible to achieve a speed of 2.1 seconds per welding cycle, or 1.05 seconds per spot, including all handling time.

Side Posts Welded With Indirect Spot Welder

While this operation is going on, sheets with stiffeners spot welded in place, and side posts, are laid out in a side jig. These side posts are formed Z-sections, with a 3-in. web, and a 2¼-in. flange toward the inside of the car. The flange welded to the car side is 1¾ in. for the ordinary post, but for posts which form a backing for the joining of sheets, the flange is 2⅜ in. Under each post an 8-in. copper bar, 10 ft. long, is embedded in the jig, completing the electrical circuit for an indirect resistance spot welder which welds the assembly together, making spot welds on 2-in. centers.

When the series welder completes the cycle of stiffener-side sheet application, the entire assembly, laid out and partially completed under the indirect welder, is moved forward and the remainder of the spot welding required to complete the side assembly is accomplished in the series welder. The side



Side Assembly Under the Indirect Welder.

(The indirect welder spots the Z-section side posts to the side sheets. The stiffeners, which are short channel- or trough-shaped strips, have already been spot welded to the side sheets.)

Crossbearers for Underframe Being Assembled in a Jig for Tack Welding.

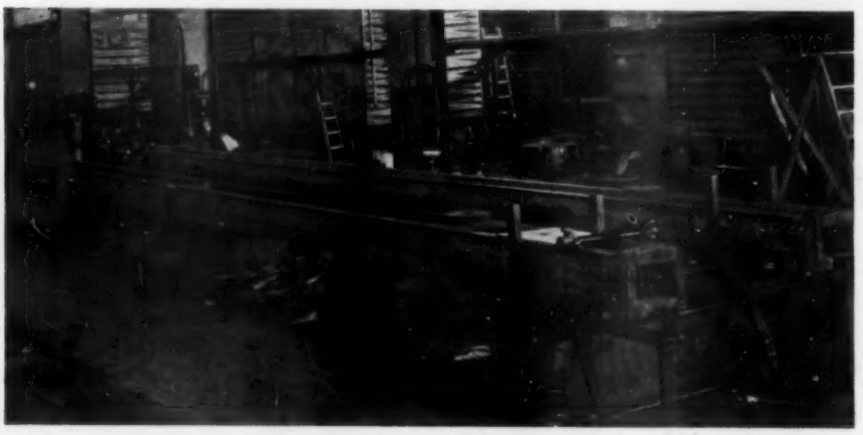
(Each crossbearer consists of a formed channel welded to two flanges. After assembly in this manner, the piece is removed to a welding table for final welding.)

Bolsters Are Finish Welded on a Revolving Welding Table.

(Right) **Underframe Bolsters Are Assembled and Tack Welded in Jigs.**

sheets, completely spot welded together, are moved along to a jig where the upper side sill element, door post, side plate, corner gusset, etc. are placed in their respective positions and are welded.

The final operation is to turn the entire assembly onto another adjacent jig, where all vertical and horizontal joints are are welded with a continuous bead. In this same position, the drip cap, upper door rail and doors are applied. This jig is long enough to accommodate two complete sides, so that the side is moved on rollers to a second position, where all scale resulting from welding is removed, employing a small electrically operated, high-frequency chisel for this purpose.



Two Center Sills on Assembly Jig.
(Each center sill is made up of two Z-sections, each over 40 ft. long, welded on the inside, then welded to the filler casting and center casting.)

In This Jig, the Bolsters, Crossbearers, Floor Stringers and Side Sills Are Welded in Place.

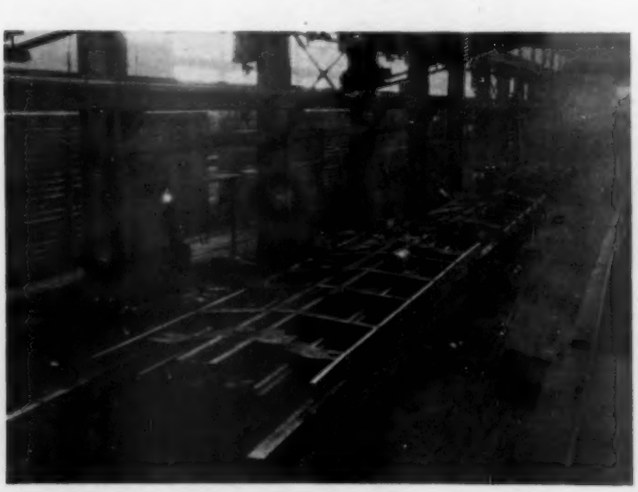
Ends: The ends are formed in two halves, which are spaced 1/8 in. apart in a jig, and welded together. In this same jig, hand brakes and safety appliances are applied to the ends. The safety appliances must be riveted in place in order to conform with the United States Safety Appliance Code, which does not yet recognize welding.

Roof: The roof is the patented Hutchins Car Roofing Co. product of pressed pan construction. These pans are welded together in a jig for that purpose, and at the same time running board brackets and running boards are welding in place. The roof is then turned over, red-leaded and the plywood ceiling applied so that it becomes a complete unit ready for erection.

Underframe: The underframe assembly commences with the bolster and crossbearer. Both these items require two welding jigs—one merely for determining of the position of the various parts and for tacking them, and the second, a welding table. In the case of the bolster, which is heavier than the crossbearer, a revolving welding table in the form of a barbeque stand is used so that the welder can work in the most convenient position at all times. All outside welds of these items are continuous.

Each Center Sill Formed of Two Z-Sections

The center sills are made up of Z-sections 40 ft. 7 1/8 in. long and 12 3/16 in. high, weighing 31.3 lb. per ft. These are welded together in a jig equipped to hold two center-sill assemblies at one time. They are welded on the inside with intermittent welds of 12 in. long, spaced 24 in. apart on centers, while the ends are welded with a continuous bead to the filler casting and between the filler and center casting. There is also a small

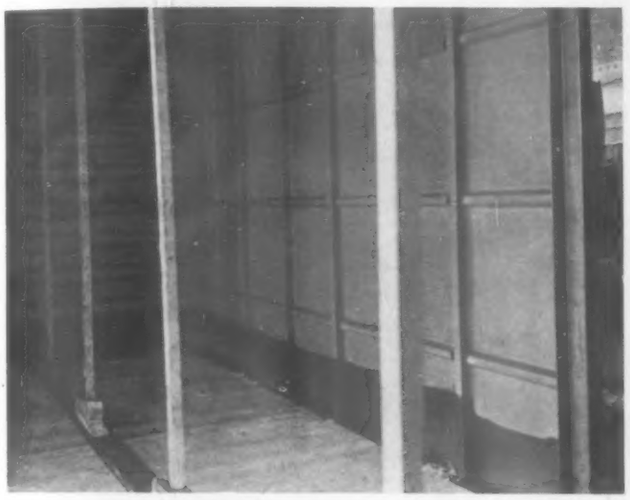


Showing Three Positions in the Progressive Assembly of the Underframe.

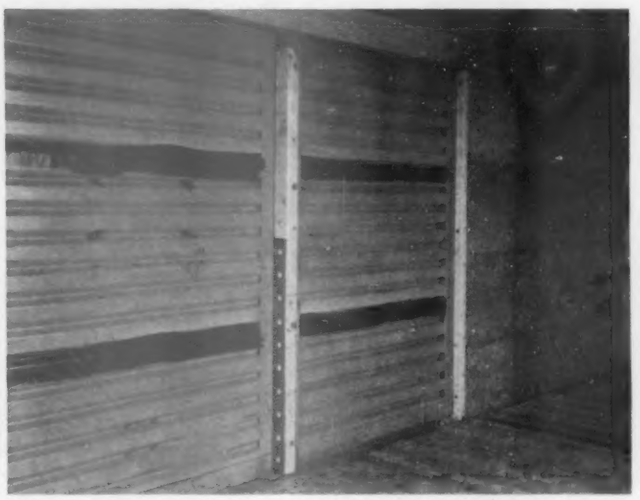
Finally the Underframe Is Turned Right Side Up and the Sills Are Welded Continuously Over the Striking Casting and Bolster.

Each Side Is Mounted in Place as a Complete Unit.

Showing Progressive Assembly of Cars.
(The car in the foreground has the sides in place, the next car has sides and ends, and the third car is completely enclosed, including roof. The roof is assembled in the aisle between the cars, the roof sections being seen in the foreground.)



Interior View of Car.



Another Interior View, Showing Plywood Finish Applied to the Walls.

amount of plug welding of the castings to the center sill. In this same position, the center and filler castings are riveted to the center sill.

The center sill assembly is moved to the next position, where the bolsters, crossbearers, floor stringers and side sill are completely welded in place, in an upside-down position. Then the entire assembly is moved to another jig, where the piping and air-brake parts are applied and the necessary brackets welded in place. In the next position, the underframe is right side up, and here is completed whatever welding is necessary, such as on the center sill where the sills are welded continuously over the striking castings and bolsters.

Assembly: The respective parts are now complete as units. The underframe is set on its trucks, which were also preassembled. Sides, ends and roof are applied in the order given, and all welded together to form one component unit. All welds joining these parts are continuous, except that the roof is plug welded to the side plates and ends by means of 11/16-in. plugs on 5¼-in. centers.

The car being completely welded together, it is thoroughly cleaned, redleaded and two coats of mineral paint sprayed on, stencilled, floor laid and bolted in place, plywood finish applied to the interior, and then inspected and released.

The All-Welded 50-Ft. Car Is 9,000 Lb. Lighter Then the Conventional Riveted Automobile Car.

There are approximately 1,300 lineal feet of arc welding and 3,860 spot welds required in the assembly of one 50-ft. automobile car. In the 40-ft. automobile car there are approximately 1,060 lineal feet of arc welding and 3,600 spot welds per car.

It is interesting to note that the weight of an average single-sheath automobile car is 56,400 lb. for a 50-ft. car

and 46,000 lb. for a 40-ft. car, as compared with 47,400 lb. and 41,200 lb. respectively, for all-welded cars. This weight saving is accomplished entirely in the body construction, as no saving of weight in trucks was accomplished and the new AB brakes actually increased the weight over the old-type K brake.

First Orders for All-Welded Hot-Blast Stoves

The first three all-welded hot-blast stoves in existence were recently completed by the Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa., for use at the Carrie furnaces of the Carnegie-Illinois Steel Co. at Rankin, Pa. The stoves, which are 24 ft. in diameter and 104 ft. overall, were fabricated from ¾- and ⅝-in. plates, all double-V butt-welded. The top of each stove is surmounted by a dome 26 ft. in diameter. Each stove is anchored with 25 3-in.-diameter bolts. The stoves are lined with checkerboard brick and have a 45-lb. internal working pressure. Thirty-eight tons of metal plates was used, and the cost was approximately $40,000. R. J. Lee was the superintendent of erection, and J. E. Jackson is manager of the erection department.

Three more all-welded hot-blast stoves for the same plant are to be built by the Chicago Bridge & Iron Co., Chicago, Ill. Three months' time will be required to erect these stoves—one to be completed each month.

The Pittsburgh-Des Moines Steel Co. has also been awarded an order for several hot-blast stoves, of all-welded construction, to be erected at the National Tube Co. works in McKeesport, Pa. They will be constructed along the same general lines as those recently installed at the Carrie furnaces, but will be of different dimensions.

Welding on New York's New Hudson Tunnel

The first (South) tube of the Midtown Hudson Tunnel, extending between West 39th Street, Manhattan, New York, and Weehawken, N. J., now more than 75% completed, will be opened for traffic about January, 1938, following completion of tile and paving installation. The tube was built, and will be operated by, The Port of New York Authority.

The length of the tube, portal to portal, is 8,215 ft., of which approximately 1,200 ft. is circular tunnel passing through rock on shore. The rock tunnel is constructed of structural steel rings, 250 in number, which are approximately 33 ft. in outer diameter throughout the 750-ft. stretch on the New Jersey side, and slightly less in diameter throughout the 450-ft. stretch on the New York side. These rings are approximately 5 ft. wide. Each ring is made up of 12 segments, these being shop fabricated by welding, using bent plates and shapes.

Welding was used for joining the steel rings through the rock tunnel, to insure both strength and water-tightness.

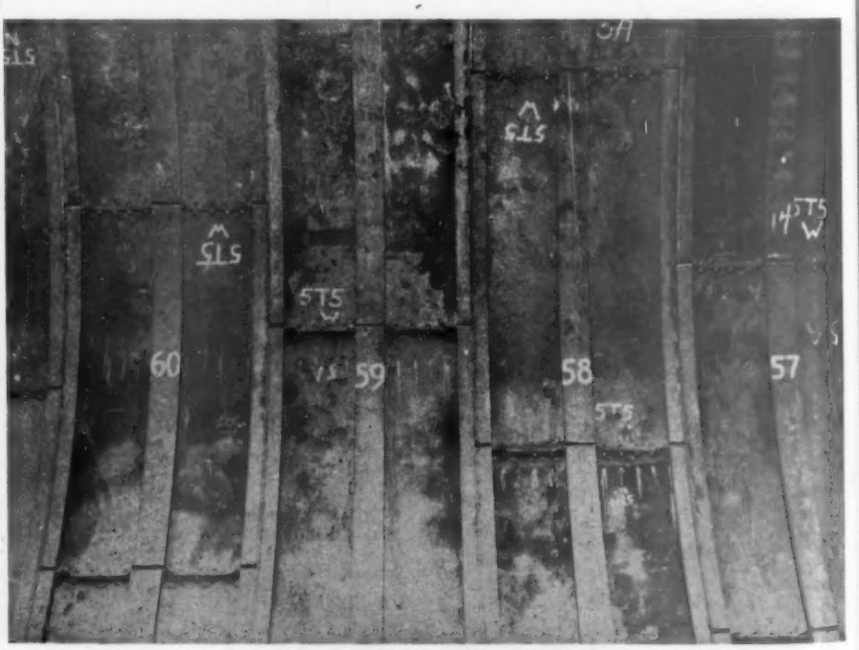
The field welding consisted of butt welding together the beam sections of the joining segments, to form a continuous beam around the entire ring, and also seal welding the circumferential joints of joining sections. The butt joints for the beams were approximately 1-in. V, while the seal welds were approximately 5/16-in. fillets.

There were 8,730 butt joints joining beam sections, and 37,000 ft. of sealing weld. Over 15 tons of shielded-arc electrodes was used, in sizes ranging from ⅛ to 5/16 in. in diameter.

In order to advance at a speed necessary for the other contractors to carry on their work, welding was carried on 24 hours a day, requiring up to 48 operators. Welding machines were mounted on movable platforms used for welding operations.

All operators were qualified for welding in all positions by inspectors of The Port of New York Authority, who also inspected all the field welding. The field welding was done by Smith-Hamburg-

Section of Tunnel With Structural Steel Lining in Place.
(Welders are joining the ring sections in the far end of the tunnel, on the other side of the canvas screen.)



View of Segmental Joints Before Welding.
(Each segment is made up by welding in the shop, then the segments are bolted together in the tunnel and welded.)

The Structural Rings of the Tunnel Are Assembled From the Near Platform, and Welding Is Done From the Rear Platform.

This Plane Has a Welded Landing Gear, Motor Mounts, Wing Braces and Fusilage Members.

■

Scott, Inc., welding contractors, Long Island City, New York.

The photographs were furnished by The Port of New York Authority and by Hobart Brothers Co.

Program Announced for Wisconsin Conference

A program of technical papers followed by discussions, as well as exhibits and demonstrations by manufacturers and suppliers of welding and cutting equipment, will feature the welding conference to be held by The University of Wisconsin, at Madison, on Thursday and Friday, April 29 and 30. All meetings will be held in the Mechanical Engineering Building, in the 1500 block on University Ave. The program announced by J. M. Dorrans, assistant professor of mechanical practice, is as follows:

THURSDAY, APRIL 29—Morning

Registration.

"Our Engineering College," by F. E. Turneaure, dean, College of Engineering, University of Wisconsin.

"Combining Steel Castings and Plate," by Harold F. Falk, engineer, Falk Corp., Milwaukee, Wis.

"Flame Hardening" with demonstration, by Dr. G. V. Slottman, Applied Engineering Dept., Air Reduction Sales Co., New York City.

Exhibits.

THURSDAY, APRIL 29—Afternoon

"Saving by Welding," by Ernst Wideman, assistant chief engineer, Oil Gear Co., Milwaukee, Wis.

"The Hazards of Electric-Arc Welding and How to Guard Against Them." (1) Engineering aspects, by Dr. E. G. Meiter, director, Industrial Hygenic Laboratory, Milwaukee, Wis., and Employers Mutual Liability Insurance Co., Wausau, Wis. (2) Medical aspects, by Dr. O. A. Sander, Milwaukee, Wis., and Consultant Employers Mutual Liability Insurance Co., Wausau, Wis.

Exhibits.

THURSDAY, APRIL 29—Evening

"What the Bureau of Standards Is Doing for Welding," by H. L. Whittemore, chief, Engineering Mechanics Section, Bureau of Standards, Washington, D. C.

Exhibits open until 10 p.m.

FRIDAY, APRIL 30—Morning

"Some Factors Determining the Choice of the Welding Process to Be Used," by Louis Larson, research engineer, A. O. Smith Corp., Milwaukee, Wis.

"Comparisons of How Welds and Rivets React Under Practical Conditions," by W. S. Kinne, professor of structural engineering, University of Wisconsin.

"Some Metallurgical Aspects of Arc Welding," by J. C. Joublanc, chief metallurgist, Harnischfeger Corp., Milwaukee, Wis.

"Welding Low-Alloy, High-Strength Steels," by A. E. Gibson, president, American Welding Society, and president, The Wellman Engineering Co., Cleveland, O.

Exhibits.

FRIDAY, APRIL 30—Afternoon

"Why Use Fabricated Steel?" illustrated with motion pictures, by J. D. Gordon, general manager, Fabricating Division, Taylor-Winfield Corp., Detroit, Mich.

Exhibits open until 10 p.m.

Transport Plane Employs Arc-Welded Construction

One of the first airplanes in which arc welding has been used to any great extent was completed recently by the Beech Aircraft Co., Wichita, Kan. The plane, known as the Beechcraft Model 18, is an 8-passenger transport with two 640-hp. radial engines, and is capable of a cruising speed of 195 miles per hour.

Landing gear, motor mounts, wing braces and a number of fusilage members were fabricated by welding, the material being SAE-X4130 molybdenum-steel airplane tubing of 0.065 in. thickness and greater, and heavy-coated electrodes were employed, according to the Metal & Thermit Corp., 120 Broadway, New York City, who describes the work.

Before construction of the plane was started, considerable experimentation and development were necessary. Jigs and fixtures to permit positioning of work were devised. A welding technique was evolved calling for the use of mild-steel electrodes in welding parts which were not to be heat-treated, and chrome-nickel electrodes on wing braces, motor mounts and other parts which were both preheated and post-heated.

All the welded portions of the plane were tested under Department of Commerce supervision and proved to have a safety factor equal to or better than the required six plus. Test welds on heat-treated parts showed tensile strengths up to 140,000 lb. per sq. in., and the completed landing gear assembly readily withstood a load test of 25 tons.

High Interest Shown at Kansas Conference

Though the attendance was not what it deserved to be, this was plentifully made up for by the high degree of interest shown in the Third Annual Welding Conference held by the University of Kansas, at Lawrence, on March 13 and 14. In addition to the papers program, exhibits and demonstrations of welding, cutting and metal spraying were participated in by 11 manufacturers and distributors of equipment and supplies.

Additions to the programs, not announced in the report in the February issue of *The Welding Engineer*, included the following talks: "Principles of Surfacing by Welding," by C. B. Herrick, The Lincoln Electric Co., Kansas City, Mo.; "Power-Plant Piping," by A. N. Kugler, Air Reduction Sales Co., New York City; and "Discussion on Containers for Liquefied Petroleum Gases," by Ed H. Gill, chief engineer, Columbia Steel Tank Co., Kansas City, Mo.

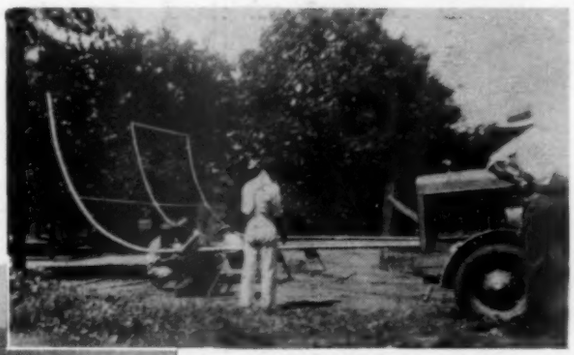
At 8:15 on Friday morning, a round table discussion was held, on courses in welding design and technique for engineering students, which was participated in by faculty members from various schools represented at the conference, and by representatives of plate fabricators, railroads, etc., and of suppliers of welding equipment.

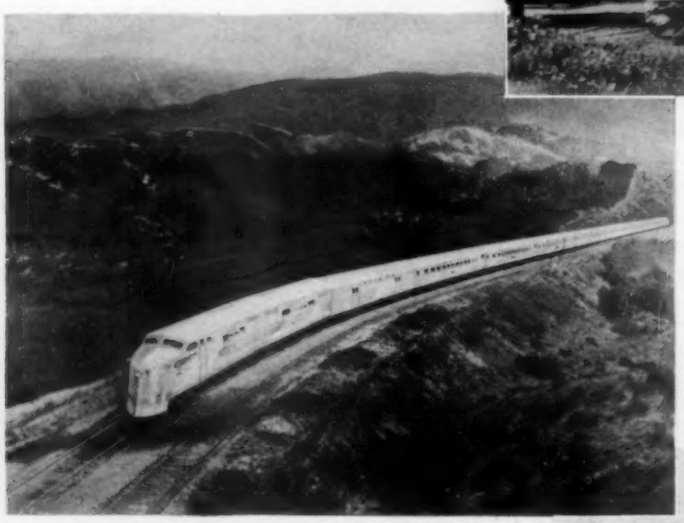
Welding Ne

• Overhead welding on the largest all-welded cargo vessel ever built on the Great Lakes. It is 300 ft. long, with 43-ft. beam and 20-ft. depth and will be powered with twin diesel engines. (Photograph from The J. L. Lincoln Arc Welding Foundation.)

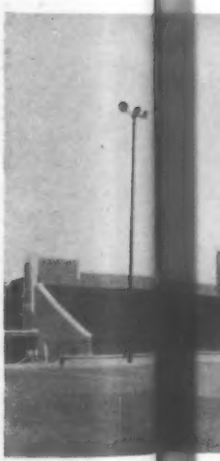
• (Left) Th... Co., of Mi... tered blizzar... while holdi... series of ... Here one of ... ing dug out ... tween Forre... S. D., with ... ing around ... graph by ... Electric & ...

• (Right) All-welded bird cage being built for the Lincoln Park Zoo, of Oklahoma City. It will be 75 ft. high, 50 ft. wide and 120 ft. long. Sections are welded on the ground, then raised and welded into place. (Photograph from the Harnischfeger Corp.)



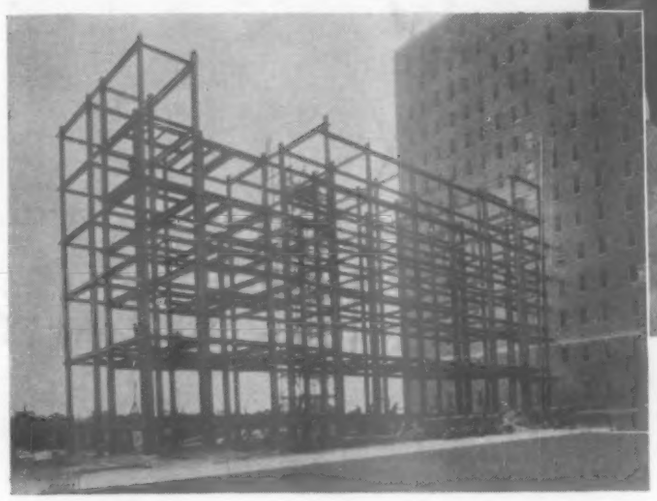


• (Left) The Santa Fe Railroad's new "Super Chief", built by the Edward G. Budd Manufacturing Co., of Philadelphia, using the shot-weld process. It has nine coaches and weighs only half as much as the train now in service.

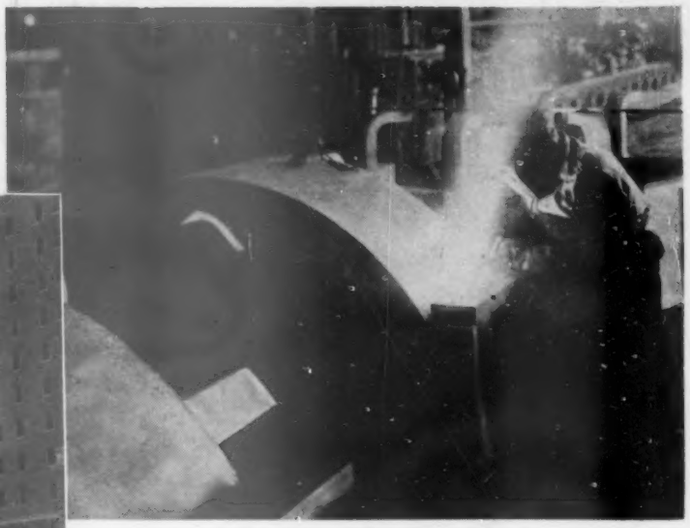


• (Right) One of two welded evaporator towers fabricated by the J. P. Devine Manufacturing Co., Mt. Vernon, Ill., for an oil-refining company. The tower is stress-relieved and x-rayed, and weighs about 98 tons. The Chicago & Eastern Illinois R. R. furnished a special car to transport it.

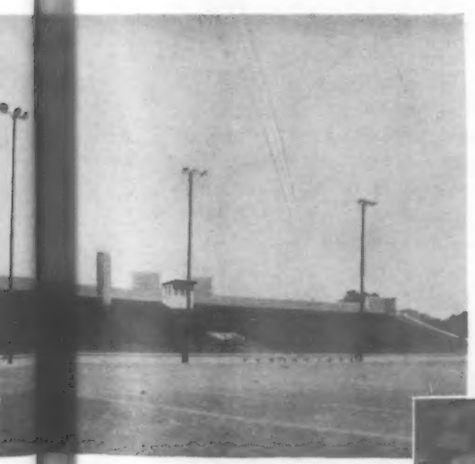
in Pictures



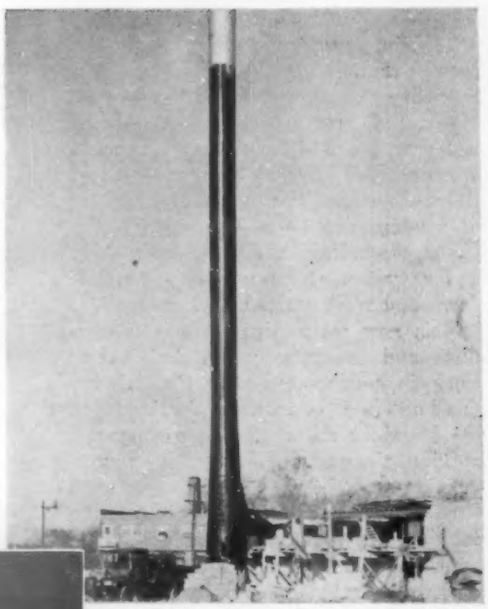
• Structural framework of west wing addition to Kings County Hospital, Brooklyn borough, which has the distinction of being the first all-welded building in New York City.



• A welder fabricating a large motor frame in the East Pittsburgh, Pa., shops of the Westinghouse Electric & Manufacturing Co.



• (Left) One of several all-welded stadiums built for the Bessemer, Ala., schools. This one is 267 ft. long, 51 ft. wide, and 31 ft. high in the back.



• 90-ft. arc-welded self-supporting steel smokestack built by the Ohio Machine & Boiler Co., Cleveland, O., for the Hillside Dairy Co., of Cleveland. (Photograph from the General Electric Co.)

Shoes, sprocket wheels and roller of a tractor built up and hard-faced by the Horn Welding Co., St. R. J. Horn, proprietor, claims built-up tracks give three to five the life of new steel parts.

Shell Lays 312 Miles of New Pipeline

By C. W. GEIGER

The history of the Shell pipelines in the San Joaquin Valley in California began in 1914, when the company built a line to transport Coalinga crude to its new refinery at Martinez. This line was a pioneer in the method of transporting heavy, viscous crudes with the aid of heat.

After 22 years this line is still in operation with the original pipe, still using the same pumping equipment, and, to a large extent, still the same auxiliary equipment.

For over a decade following completion of the line, Shell's attention was turned to other fields of production, most important of which was Signal Hill, which it discovered. It also had a big share in developing Santa Fe Springs, Brea, Dominguez and Ventura Avenue fields. A network of pipelines was built to tie these fields into the company's refinery at Wilmington.

In the San Joaquin Valley, Shell discovered the Mt. Poso field, acquired large holdings in the Round Mountain and Kettleman Hills fields, discovered Mountain View and developed the Edison field.

The company had no pipeline in this area at that time and the Coalinga-Martinez line was already taxed to capacity. When Ten Section field was discovered last year the need for an additional line became really urgent. So Shell's new Bakersfield-Martinez pipeline, capable of meeting present and future requirements, including a central tank farm and a system of lateral lines, was laid down and work started.

This new main pipeline was a complete and separate system designed to work in conjunction with the existing line built in 1914 between Coalinga and the Martinez refinery. The new system required the construction of four pumping stations between Bakersfield and Coalinga and mechanical additions to the existing six pumping stations between Coalinga and Martinez.

Four lateral lines were constructed as a part of the project; an 8-in. line from the Mt. Poso field, 12 miles long; a 6-in. and 8-in. line, 9 miles long, from the Round Mountain field; an 8-in. line, 17 miles long, from Shell's newly discovered Ten Section field; and a 6-in. line 21 miles long, from the Mountain View-Edison area. All terminated at a central tank farm.

The new main line from Bakersfield tank farm via Caliola pump station near Coalinga, to Martinez, is 258 miles long and consists of 190 miles of 10-in. pipe and 68 miles of 12-in. pipe.

The old or existing line, from Caliola pump station and tank farm to Martinez refinery consists of 140 miles of 8-in. pipe and 30 miles of 10-in. The new main line parallels the existing line from Caliola pump station to Martinez refinery, utilizing second line rights obtained at the time the original line was built, thereby greatly reducing the amount of new right-of-way to be acquired.

The route selected for the southern end of the line was the shortest distance between Bakersfield tank farm and Caliola, consideration being given to other areas of production to which lateral pipeline connections might be made in the future, and other important engineering considerations such as avoidance of improved agricultural lands, ease of transportation and feasibility of construction.

The general contractors, Lindgren & Swinerton, completed the laying of the new main pipeline and laterals (312 miles in all) in the remarkable time of 90 days. They also completed the four new pump stations and made additions to the other six in a similar period of time.

H. C. Price, Inc., of Bartlesville, Okla., performed all welding operations on the project. Their crews made the first weld on July 22, 1936, on the main line, and the last firing line weld on October 21 at a point near Meganos pump station in Contra Costa county. Possibly the statement that the welding contractors made the last weld is inaccurate if we remember that the last, or "golden weld," was made, with appropriate ceremonies, by Shell's president, S. Belither, with the assistance of his manufacturing and marketing vice-presidents C. H. Van Senden and W. P. Durkee.

The pipe used in the construction of the main line and laterals is A. P. I. grade B seamless line pipe. All pipe was beveled for welding at an angle of 37½° and all field joints were made by the metallic-arc method, each weld being built up in three beads. Field tests were accomplished by applying compressed air at a pressure of 180 lb. on completed sections of three to five miles in length, the welds being given the soapwater leak detection test.

Slack was provided in the 6-, 8- and 10-in. pipe by use of vertical "slack-wallop," and in the 12-in. pipe by "horizontal-wallops."

In laying the main and lateral lines, side-boom tractors, ditching machines and other necessary equipment, which included 40 arc-welding machines, were supplied to outfit four complete construction crews working simultaneously on different sections of the line. Original points along the line from which these four crews started were Bakersfield (all laterals), Bakersfield pumping station to Caliola, Caliola to Meganos pump station, Meganos to Martinez. All crews finished surprisingly close together in the matter of time. The best day's run of any crew during the progress of the work was 5.25 miles of 10-in. line completely tied in. The daily average for all four crews was 3.51 miles of completed line.

State highways and railroads crossed, bored and cased, together with county road and irrigation canal crossings counted, totaled 78. Each required special attention to conform to the regulations prescribed by local governing authorities.

In addition to these 78 crossings, two passages of the Kern River were made —one on the Ten Section lateral, the other on the Mountain View lateral. These were made in the orthodox manner—that is, river clamps were installed over each joint and bowed upstream to insure permanent burial under the river bed.

Two suspension-type bridge crossings were necessary. The first was across Big Panoche Creek north of the Cheney pumping station. This bridge was built in 1914 to accommodate the existing pipeline with ample provision for taking additional lines. The second, across Los Banos Creek, two miles north of the Merval pumping station, is of similar design and was built as a part of the new line; it is 260 ft. long between suspension towers. Approved expansion joints were installed at each of these suspension bridges. Similar expansion joints were inserted into the line wherever it is exposed to the elements for a distance of 150 ft. or more. These expansion joints have proved necessary to hot oil-line operation, eliminating entirely difficulties from expansion and contraction of the line at these points.

Expansion joints were also installed on the discharge side of all pumping stations to protect the station manifold and yard piping against undue strain from expansion or contraction.

Because of the necessity of collecting ahead and temporarily storing the crude coming in from the laterals, a complete new tank farm was erected, strategically located some five miles north of Bakersfield.

At the tank farm six 68,000 barrel A. P. I. tanks were erected, each being 102 ft. in diameter, 8 rings high, with welded bottom, riveted shell and welded cone roofs. Also there were built two 68,000-barrel tanks of similar specifications, except that these were equipped with Wiggins pontoon roofs. These provided a total gross storage at Bakersfield tank farm of 544,000 barrels.

The tank-farm is so situated on gently sloping ground that the tanks provide a suitable gravity head on the pumping station, which is connected to the tanks through a large-diameter suction pipe system, inclining gently upwards to the tank farm.

At Caliola tank farm two 68,000-barrel pontoon-roof-equipped tanks were added to the existing storage, which con-

sisted of 17 55,000-barrel steel tanks erected in 1914.

The elapsed time for the engineering, design, purchase and delivery of equipment, hauling, erection and construction on the entire project was slightly more than seven months. The number of men working was about 500 and the cost involved was slightly in excess of $4,500,000.

Heat-Treating of Metal Surfaces With the Arc

By A. M. MAC FARLAND
Consulting Welding Engineer

In the hardening of carbon steel by the local application of a gas flame, a surface layer is heated to a high temperature by an oxyacetylene flame. On removing the flame, before the heat has had time to sink deeply into the metal, the hot surface metal is quickly cooled by the colder underlying metal and is hardened as a consequence.

The aim of the process is to heat the surface as quickly as possible, without heating the underlying metal. The hotter the flame the better—up to a point where the surface is fused or roughened, and in many instances even this is not detrimental.

The temperature of the electric arc, being much higher than that of the gas flame, makes it especially adapted to this work, subject to limitations imposed by the need to preserve the metal surface against possible fusion. Electric heat is much cheaper than gas heat, and it is possible to find many instances where it may be used for such surface hardening to advantage. In fact, it has been so used in some shops over a long period of years. For example, in certain building-up processes, extremely hard areas have been found.

The writer recalls that about 10 years ago an Eastern street railway company established the custom of building up worn flanges and treads on street-car wheels by rotating the wheels at a peripheral speed of about 12 to 18 in. per minute, under an automatic arc-welding head, feeding 3/16-in. welding rod continuously to the arc. They would build up one or two layers, and sometimes more. They were able to build up a flange starting at a feather edge on the side of the wheel. The wheels later were then turned in a lathe to true up the surface.

The saving effected over the cost of new wheels averaged about $4 per wheel. The majority of the wheels were soft steel, but among them were some of higher carbon content (Edgewater wheels).

When the wheel surface was built up, there was a glass-hard layer where the weld metal joined the carbon steel. The writer, quoting the figures from memory, recalls that the soft steel built-up surface would run about 50,000 miles before wearing down to the hard layer, but after the hard layer was reached, apparently the wheels would run indefinitely without any further perceptible wear.

Of course, the question of wearing the tracks instead of the wheels is a factor, but at the moment we are interested in electrical surface hardening, and here was a practical example of this done on quite a wholesale scale 10 years ago.

For electrical heating of new surfaces, without damaging them, the carbon arc has possibilities. If a carbon arc is given direction by a strong magnetic field, it can be made to blow like a gas flame, and may be directed and held on a sharp corner or on any desired path. If this arc is moved rapidly over a metal surface, it is possible to regulate the amount of heating and to limit the depth of the hardening to a thin layer.

Experimenters working with this process should first try it out on some scrap material and learn the limitations of control possible and also learn just how much or how little the surface may be roughened by the arc, before moving onto the final job.

Alloys for Electrodes for Use in Resistance Welding

By J. DELMONTE

A number of alloys which have recently made their appearance, combine great hardness with high electrical conductivity, thus making them practically desirable as electrodes for resistance-welding machines. From a metallurgical standpoint, high-conductivity electrical alloys are rare and of comparatively recent origin. Pure copper and pure silver form the most satisfactory electrical conductors, but are unsuitable as electrode material for resistance welding owing to their comparative softness. The additions of small amounts of alloying metals will increase the hardness of the metal, but lower the electrical conductivity.

In resistance-welding operations a high pressure must be brought to bear upon small, tapered welding electrodes, which are designed to meet the requirements of spot- or seam-welding operations. For economy of operation and for long, satisfactory service, the electrode points must not become flattened out under the repetitive applications of pressure, as one of the prerequisites of successful spot welding is the concentration of a high amount of electrical energy within a very small area. If the points are broadened, not only is the electrical energy distributed over a greater area of metal, rendering it more difficult to fuse the metal in a given period of time, but also there exists a greater heat-dissipating volume, which acts contrary to the primary behavior of the spot-welding operation.

The concentration of high heat in a very small area in a very short period of time are the cardinal features of spot welding. The ability to deliver the required electrical energy to the spot weld is a function of the electrical conductivity of the welding electrode. Consequently, the development of welding electrodes should strive toward high electrical conductivity associated with hardness of material.

Binary alloys of beryllium-copper (2.5% Be) were first proposed for welding electrodes. These alloys possess a very high tensile strength in the heat-treated condition and a comparatively high electrical conductivity. The chief drawback of this alloy is the fact that the heat developed during the welding operations anneals the alloy, placing it in a soft-annealed condition, still with good electrical conductivity, but too soft for the purpose intended. In addition, the cost of these binary alloys is prohibitive as compared to the other alloys discussed in the next paragraph. The comparatively high cost of all of these alloys is due to beryllium metal, which sells in the neighborhood of $40 a pound. However, beryllium's remarkable alloying properties have made it indispensable.

The Germans have played a leading part in a number of the developments of ternary alloys of beryllium. Beryllium-copper-cobalt is a typical example. However, its application to resistance welding was developed in the United States. A number of these alloys are listed in the table below. By bearing in mind the significance of high strength and good electrical conductivity in weld-

DATA ON ALLOYS FOR RESISTANCE-WELDING ELECTRODES.

Composition	Brinell Hardness	Electrical Conductivity	Tensile Strength, lb./sq. in.	Elongation
2.6% Cobalt 0.4% Beryllium 97.0% Copper	200-220	50% IACS*	90,000-115,000	10-15%
0.4% Chromium 0.1% Beryllium 99.5% Copper	140	70%-75% IACS	50,000-60,000	10-15%
0.3% Beryllium 0.5% Zirconium 99.2% Copper	.....	82%-85% IACS	40,000-67,000	.....
0.15% Beryllium 0.85% Chromium 99.0% Copper	.....	65%-69% IACS	45,000-74,000	.....
0.4% Beryllium 0.5% Silicon 2.6% Cobalt 96.5% Copper	.....	55%-58% IACS	100,000	.....

*IACS—International Annealed Copper Standard.

ing electrodes, the possibilities may be noted.

The majority of the above alloys possess high proportional limits, which means that they will withstand high bearing pressures without deformation or permanent set. They are truly unique in their high values of electrical conductivity. Phosphor-bronze, long used for electrical contact parts, has a conductivity 7%-10% of the annealed copper standard.

The ternary alloys in the above table may be heat-treated, in order to bring out the most desirable mechanical qualities. They may be machined before heat-treatment, while still in a soft-annealed state, and then heat-treated to bring the finished part or electrode up to the right temper. The alloys in the table above can be heated considerably higher in temperature than the ordinary beryllium-copper alloy, before losing their temper.

The welding-electrode alloys containing cobalt have given satisfactory service in the resistance welding of stainless steels, and are suitable for projection and flash welding of plain carbon steels. They are not recommended, however, for the spot or seam welding of plain carbon steels. The chromium ternary alloys fulfill, in the main, all welding requirements of plain carbon steel.

Large Butt-Welded Stacks Under Erection

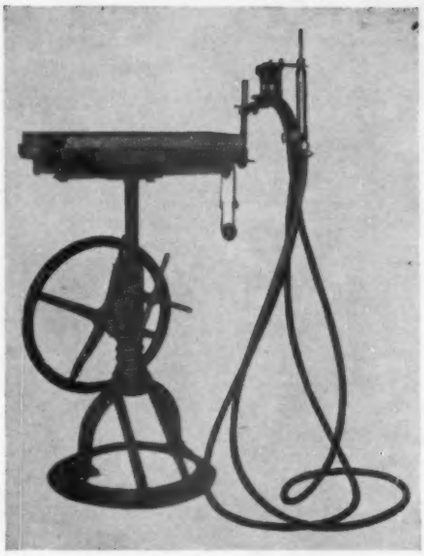
Three large stacks, with all plates butt welded, are being erected by the Atlas Boiler & Welding Works, Inc., 205 S. Ninth St., Louisville, Ky., according to Jefferson Lentz, president of the concern. The largest, which will be 165 ft. high and 96 in. in diameter, is being erected for the Vincennes Packing Corp., of Vincennes, Ind. The other two stacks are being erected at Bardstown, Ky.—one, measuring 120 ft. by 54 in. in diameter, being built for the Bardstown Distillery Co., and the other, 100 ft. by 48 in., being erected for the Nelson County Distillery.

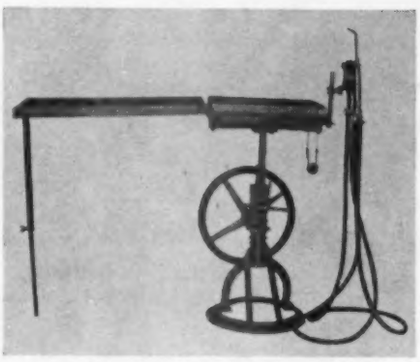
Adjustable Welding Table With Extension

By EDWIN KILBURN
Kilburn's Machine Shop, Spring Valley, Minn.

The welding table illustrated herewith is used by us in small repair work. It can be used with or without the extension. The extension is made of angle iron with cross strips of flat steel welded to the sides, the leg for the extension being made telescopic in order that it may readily be adjusted for height and the extension may be used level with the main table, or slanted to fit the job. The extension may be used on any of three sides of the table as required.

The main table is adjustable vertically from 28 to 42 in. in height by means of a handwheel, and is locked at any height desired by means of a screw operated by the four-armed handle shown. This clamp screw has a spring-cushioned bronze end bearing against the side of the upright square post.





Welding Table, Without and With Extension.

The small pan shown on the front of the main table is for flux cans and may be placed on any one of three sides of the table, suitable strips being provided on which to hang the pan hooks.

The firebrick top of the main table is 13x18 in., and the extension is 14x30 in. The gas-saver shown in the illustrations as a part of the table top, is an essential device.

Death Takes H. R. Hurlbut

Harry Rogers Hurlbut, secretary and general counsel of the National Cylinder Gas Co., Chicago, died suddenly at his home in Evanston on March 18. He was born in 1877, and was educated in the Chicago public schools and at the University of Michigan and Northwestern University. Mr. Hurlbut was well known within the oxyacetylene industry, having been counsel for the Keith Dunham Co. since 1921, and when this company was absorbed by the National Cylinder Gas Co., he continued as counsel and became secretary of the corporation as well.

Pittsburgh Engineers Take Course in Welding

Engineers, welding superintendents, designers, foremen and operators, and other industrial men will be offered advanced instruction in the practical and theoretical aspects of arc welding, when a course in advanced arc-welding design and practice is given in Pittsburgh, Pa., by the Pittsburgh office of The Lincoln Electric Co., Cleveland, O. Meetings will be held during the week of April 19, at the Clifford B. Connelly Trade School. The course will be under the direction of E. W. P. Smith, well-known welding authority of Cleveland.

Other notable speakers at the meetings will include H. C. Boardman, director of research, Chicago Bridge & Iron Co., Chicago; Thomas Johnston, engineering department, Whitehead & Kales Co., Detroit; E. E. Tross, plant manager, United Engineering & Foundry Co., Youngstown, O.; Fred L. Plummer, associate professor of structural engineering, Case School of Applied Science, Cleveland; and L. C. Bibber, welding engineer, Carnegie-Illinois Steel Corp., Pittsburgh.

The recent shortage of arc welders in the Pittsburgh area has caused much thought on the part of people interested in the welding situation. The Lincoln Electric Co. sponsored the course in order to interest general industrial workers and former welders who, during the depression years, turned to other work. With the recent activity in the steel industry, centering in the Pittsburgh area, the need for welders and welding instruction is great.

Iowa Conference Rolls Up Large Attendance

At the Ninth Annual Welding Conference held at Iowa State College, Ames, Iowa, on March 24 to 26, a total of 404 reservations were made, compared with last year's 270, and representatives were present from 30 manufacturers and distributors of welding and cutting equipment and supplies, to take part in the exhibits and demonstrations held in connection with the conference.

International Body Asked to Devise Rules for Welders

Committee C52, on electric-welding apparatus, of the American Standards Association, was recently asked to recommend an answer for the United States National Committee of the International Electrotechnical Commission to make to the central office of the Commission on whether the Commission should undertake the development of in-

ternational rules for electric-welding apparatus and equipment. The proposal had been suggested by the Netherlands National Committee. Committee C52 recommended favorable approval.

Correction in Author's Name

The author of the article, "Metallurgical Problems of Welding in the Automobile Industry," appearing on pages 25 to 29, in the March issue of *The Welding Engineer*, is Dr. Armand Di Guilio, to whom apologies are offered for the misspelling of his name in the head of the article and in the announcement on page 36 of the February issue regarding the meeting at which the paper was read.

Lincoln Foundation Appoints Powers Assistant Secretary

Edmond C. Powers, who has been engaged for three years in technical writing for The Lincoln Electric Co., Cleveland, O., has been appointed assistant secretary of The James F. Lincoln Arc Welding Foundation. Prior to starting work with Lincoln, he served the Penton Publishing Co. four years as associate editor of two monthly technical publications in the marine field. Practical mechanical and manufacturing experience was gained at Rolls-Royce of America, Inc., Springfield, Mass., following graduation from Amherst College. During the past year, under supervision of A. F. Davis, Lincoln vice-president, and with the assistance of various Lincoln engineers, Mr. Powers edited and produced the Fourth Edition of the "Procedure Handbook of Arc Welding Design and Practice."

Welded Ship Tonnage Shows Increase

The application of welding in the construction of steel ships is making sensational progress throughout the world, according to an announcement made yesterday by the marine division of the International Welding and Fabricating Society, which declared that there is 235% more welded tonnage under construction today than at this time a year ago.

The society's marine division held its annual forum and meeting on April 5, at 1472 Broadway, New York City, at which leading American shipbuilding, ship-repair and marine-engine firms were represented by their engineers.

The resident director of the society, A. A. Primrose, said that a number of firms and individuals were cited for meritorious achievement in 1936 in the welding field, also that the society had licensed last year 10 senior welders, 40 master welders, 692 certified welders and 1,115 juniors. The same period saw 5 senior welding engineer licenses issued, as well as 15 master engineers and 41 ordinary.

Booklet on Protection of Welders' Health

"Health Protection of Welders" is the title of a new 27-page booklet published by the Industrial Health Section, Metropolitan Life Insurance Co., New York, N. Y., in which are discussed hazards from fire and electric shock, burns, radiant energy, and gases, fumes and dust.

The effect of invisible radiation on the eyes, is discussed and protective measures considered. Considerable treatment is given the subject of gases produced by welding and cutting, either with the arc or the gas flame, and effects of various metallic or mineral oxides, volatilized by heat, on the health of the welder or the metal-spraying operator.

New Motion Picture on Hard-Facing

A new motion picture on hard-facing which shows, in detail, the process of adding wear-resisting surfaces to steel parts, is now available for showing to interested organizations or groups. This picture was produced by the Haynes Stellite Co., Kokomo, Ind., and can be obtained for showings through representatives of either that company or The Linde Air Products Co.

The film begins with a brief description of what hard-facing is and how it is done. The scene then shifts to a series of unique views of the application of Stellite with the oxyacetylene flame. Following this are views of various industrial applications of hard-facing, such as its use on steam valves for high-temperature, high-pressure service, automotive-valve-seat inserts, cement-grinder rings, and dipper-bucket teeth. Throughout the film, emphasis is placed on effective methods of application and the economies resulting from the use of hard-facing.

Atom-Smashing Machine Will Be Welded

Welding will play an important part in the latest attempt to divide the atom, a feat which scientists have been trying ever since the atomic theory was introduced. Now, with the aid of special all-welded equipment, Dr. William H. Wells and M. W. Smith, both of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., may succeed in doing what no scientist ever has been able to do.

Plans for the construction of a giant "atom-smashing cannon," which is to be all-welded, are under way at the Westinghouse research laboratories. The cannon, consisting of a 28-ft.-long vacuum tube, will be housed in a pear-shaped steel bulb, 47 ft. tall, with its muzzle emerging downward into a small laboratory situated under the bulb.

Using five million volts as the powder for the cannon, the scientists will attempt to find out just what happens to certain chemical elements when subjected to a terrific electrical bombardment. The work will be under the direction of Dr. Wells, formerly of the University of Minnesota, who joined the Westinghouse staff last June.

Chattanooga Conference Program Announced

The Second Southeastern Welding Conference to be held by Compressed Industrial Gases, Inc., will hold forth in the exhibit hall at 1410 Cowart St., Chattanooga, Tenn., on Tuesday, April 20, to Friday, April 23. In addition to demonstrations and exhibits, talks will be given and a welders' roundtable discussion held each day. The program announced by J. D. Williams, district sales manager, is as follows:

TUESDAY, APRIL 20

9:30 a.m. Registration.
10:00 a.m. Address of welcome.
10:15 a.m. "Training the Modern Welding Engineer," by D. A. White, University of Tennessee.
10:45 a.m. "Welding of Cast-Iron Parts," by Roy Peterson, Peterson Laboratories, Emporia, Kan.
11:15 a.m. "Recent Developments in Arc Welding," by L. A. McGraw, General Electric Co.
1:00 to 5:00 p.m. Demonstrations.
7:00 p.m. Welders' Round Table. Discussion leader, L. C. Monroe, advertising manager, "The Welding Engineer," Chicago.
8:00 p.m. Sound movies, by courtesy of the General Electric Co.
8:30 to 10:30 p.m. Demonstrations.

WEDNESDAY, APRIL 21

10:00 a.m. "Carbide Doings," by W. F. Kuhl, Shawinigan Products Corp., New York City.
10:30 a.m. "X-Raying and Testing of Welded Pressure Vessels," by Corbin Chapman, Combustion Engineering Co., Chattanooga, Tenn.
11:00 a.m. "Safety in Oxyacetylene Equipment," by L. F. Fausek, vice-president, Modern Engineering Co., St. Louis, Mo.
11:30 a.m. "Important Aspects of Welding," by L. C. Monroe, "The Welding Engineer," Chicago.
1:00 to 5:00 p.m. Demonstrations.
7:00 p.m. Welders' Round Table. Discussion leader, L. C. Monroe.
8:00 p.m. Movies.
8:30 to 10:30 p.m. Demonstrations.

THURSDAY, APRIL 22

10:00 a.m. "Training of Welding Operators," by C. T. Raymo, Chattanooga Boiler & Tank Co., Chattanooga, Tenn.
10:30 a.m. "Bronze Welding," by G. H. Emin, sales manager, Titan Metal Manufacturing Co., Bellefonte, Pa.
11:00 a.m. "Welding of Manganese Steels," by E. L. Quinn, American Manganese Steel Co., Chicago.
11:30 a.m. "Liquid Oxygen," by E. J. Lowrey, chief engineer, Compressed Industrial Gases.
1:00 to 5:00 p.m. Demonstrations.
7:00 p.m. Welders' Round Table. Discussion leader, L. C. Monroe.
8:00 p.m. Movies.
8:30 to 10:30 p.m. Demonstrations.

FRIDAY, APRIL 23

10:00 a.m. "Spraying of Metals," by W. H. Ludington, vice-president and general manager, Metals Coating Co. of America, Philadelphia, Pa.
10:30 a.m. "Arc Welding With Bronze in the Railroad Shops," by M. G. Steele, technical adviser, Revere Copper and Brass, Incorporated, New York City.
11:30 a.m. Demonstrations.
1:00 to 5:00 p.m. Demonstrations.
7:00 p.m. Welders' Round Table. Discussion leader, L. C. Monroe.
8:00 p.m. Awarding of prizes.
8:30 to 10:00 p.m. Demonstrations.

Meetings

Chicago

A meeting of interest to architects is planned by the Chicago Section, American Welding Society, to be held April 16, at the Armour Institute of Technology. The speakers will be George Fred Keck, architect, and A. S. McCawley, of Thos. J. Douglass & Co. A. E. Gibson, president of the American Welding Society, has accepted an invitation to be present; he will discuss some matters of interest to the Society.

Mr. Keck, who was the designer of the Crystal House and the House of Tomorrow at A Century of Progress, will speak on "What Has Welding to Offer the Architect?" Mr. McCawley's topic will be "Welding in the Construction of Building Piping Services."

The regular meeting of the season, at the Welders Information Center, 741 West 70th St., will be held on Tuesday, May 4, at 8 p. m. Subsequent meetings will be held on the first Tuesday of every month. At the May 4 meeting, J. C. Menzies, of C. E. Phillips & Co., will talk on special welding problems, and will demonstrate the making of machineable welds in cast iron with the arc, hard-surfacing of agricultural and industrial equipment, and special applications to tools and dies. A motion picture on tools and dies will be shown. There will also be a demonstration of the new "Will-Weld" a.c. welder by C. P. Nielsen and N. A. McClean, both with the Will-Weld Manufacturing Co.

• • •

Detroit

The Detroit Section, American Welding Society, will hold their May meeting in conjunction with the national meeting of the American Society of Mechanical Engineers, to be held May 17 to 21, at the Hotel Statler, Detroit. One session, on May 19, is to be devoted to welding with the American Welding Society cooperating. Col. A. S. Douglas, of The Detroit Edison Co., will be chairman of that meeting. Speakers will be Everett Chapman, president of the Lukenweld Co., Inc., Coatesville, Pa., and C. L. Eksergian, chief engineer of Budd Wheel. Mr. Chapman's subject will be "Welded Steel in High-Speed Railway Service." Mr. Eksergian will present a paper on "Hydromatic Welding of Frames."

The April meeting of the Detroit Section, American Welding Society, the date for which had not been set when this item was prepared, will be held in commemoration of Elihu Thomson, the inventor of the resistance-welding machine. Albert E. Hackett, of Thomson-Gibb Co., will give the history of welding during the past fifty years.

At the meeting of the Detroit Section held on March 26, T. C. Fockler, of the Westinghouse Electric & Manufacturing Co., spoke on "Welded Machine Designs." R. R. Bozell, of Whitehead & Kales Co., was chairman.

• • •

Kansas City

The newly organized Kansas City Section of the American Welding Society held its first meeting on March 1, at which the following officers were elected: Chairman, C. E. Woodman; vice-chairman, J. A. Hall; treasurer, J. M. Culver, and secretary, Albert W. Roth. The following members were elected to serve on the Executive Committee: LaMotte Grover, A. H. Sluss, Walter H. Kurtz, N. R. Sack, L. L. Cramer, and C. W. Frick. The other members of this Committee had not yet been chosen at the time this item was prepared.

At the March 13 meeting of the Kansas City Section, A. E. Gibson, president of the Society, gave an interesting talk in which he outlined the program of the Society for the next several years. This meeting was in the nature of a banquet, attended by 75 members and guests.

The membership of the Section had gone up to 55 at the time of Mr. Gibson's visit. The Membership Committee, headed by G. F. Dickins, is active, and a goal of 100 members has been set for the end of 1937.

• • •

Los Angeles

The March 18 meeting of the Los Angeles Section of the American Welding Society dealt largely with aviation. A motion picture showing an interesting and comprehensive collection of historical aviation pictures was shown by Zeno Klinker, humorous writer and aviation enthusiast. Bruce Burns, consulting aircraft engineer, gave an illustrated talk on "Aircraft Spot Welding of Aluminum Alloys and Corrosion Resisting Steels," using data obtained during actual fabrication at the aircraft plant of the Northrop Corp. at Inglewood, Calif. A review of the important articles in the current issue of the society's official organ, *The Welding Journal*, was given by B. T. Brugge. Before adjournment, a general discussion lead by Turner Smith, of the General Petroleum Corp., was held on the American Welding Society Code for Qualification of Welding Processes and of Welding Operators, an effort being made to arrive at a definite recommendation by the section for the national organization.

• • •

Milwaukee

"Arc Welding in Structural Engineering" was the subject of a talk by A. M. Candy, consulting engineer, Hollup Corp., of Chicago, at a joint meeting of the Milwaukee Section, American Welding Society, with the American Society of Civil Engineers, on March 30.

New York

"Stresses in Welded Joints and Their Elimination" is the title of a paper to be given by Everett Chapman, president, Lukenweld, Inc., Coatesville, Pa., at a joint meeting of the New York Sections of the American Welding Society and American Society for Metals, on Monday, April 19, 8 p. m., at the Metal Products Exhibit Hall, third floor, International Building, Rockefeller Center. C. W. Bryan, Jr., vice-president, Federal Shipbuilding & Dry Dock Co., will be chairman. The meeting of the New York Section on "Shipbuilding" scheduled for April 13 has been postponed until next fall. The annual business meeting will be held on May 11, with motion pictures on new developments in welding and cutting.

• • •

Philadelphia

An inspection tour of the General Electric Co. plant at 72nd and Elmwood Sts., Philadelphia, will be made by the Philadelphia Section of the American Welding Society, starting at 1:30 p. m. on Tuesday, May 18.

• • •

Pittsburgh

R. B. Lincoln, director, National Weld Test Bureau Division of the Pittsburgh Testing Laboratory, is scheduled to speak on "Safety in Welding" at the regular monthly meeting of the Pittsburgh Section of the American Welding Society on Wednesday evening, April 21, at the Roosevelt Hotel.

• • •

San Francisco

The March meeting of the San Francisco Section, American Welding Society, was held over until April 2 on account of program arrangement difficulties. The main speaker was W. E. Emmett, district engineer of the American Structural Steel Association, whose subject was "The Welding of Structural Shapes in Buildings and Bridges."

Coming Events

Apr. 29-30. Madison, Wis. Annual Welding Conference at University of Wisconsin, with exhibits. For information write J. M. Dorrans, Superintendent of Engineering Shop Laboratories.

May 3-7. Milwaukee, Wis., Municipal Auditorium. Annual Convention of American Foundrymen's Association. For information write C. E. Hoyt, Secretary, 222 W. Adams St., Chicago, Ill.

May 24-27. Atlantic City, N. J., Auditorium. Annual Meeting of National Association of Master Plumbers.

June 28-July 2. New York City, The Waldorf-Astoria. Fortieth Annual Meeting of American Society for Testing Materials, and exhibit of testing apparatus and related equipment. For information write C. L. Warwick, 260 S. Broad St., Philadelphia, Pa.

Oct. 18-22. Atlantic City, N. J., Municipal Auditorium. National Metal Congress and Exposition. Also Annual Meeting of the American Welding Society, American Society for Metals, Wire Association, and other organizations. For information write W. H. Eisenman, 7016 Euclid Ave., Cleveland, O.

Preheating and Welding Cast-Iron Parts

By H. C. CARBY

By observing a few precautions, you can obtain perfect jobs in welding cast iron by the oxyacetylene process, using cast-iron rods, whether the casting be simple or complicated.

The proper procedure in welding large or small cylinder blocks or heads is to place the casting on a few firebrick on the preheat table so as to get heat under the casting as well as all around it. Place one row of firebrick about 2 in. apart and about 3 or 4 in. from the casting, and on top of these build up a tight wall of firebrick the shape of the casting and to the same height. Fill the space with charcoal and cover with asbestos. Light the charcoal through the lower layer of firebrick with the torch.

It is only necessary to get a few pieces of charcoal burning and you will soon have a nice, even heat. Since the heat rises, you will have as much heat at the top as at the bottom. Now you can do some other work and in an hour or so, if the casting is not up to a dull-red heat, you might have to put on additional charcoal. When a dull-red heat is obtained, make an opening in the asbestos and start to burn down through the fracture on the inner side of the casting and work out to the edge. Be sure to cut to the bottom and to follow the crack.

I prefer burning out the crack with the torch rather than chipping, since you can then easily place the broken sections in their original places before placing in the fire. By burning out the crack with the torch you also put the necessary heat into the casting to start welding, and avoid any hard spots and boiling of the metal which will cause pin holes.

If pin holes show up, it is because the base metal was not hot enough for the added metal. The added metal should not be too liquid or thin if the base is cold. Keep the molten metal as thick as possible and work the filler rod into the parent metal, giving particular attention to the sides of the weld to work out any sand that may be in the casting. The metal will flow out smoothly and not high in one point and low in another.

After the weld is built up to the desired height, melt the surface to see if you have any pin holes. Melt around any pin hole and go to the bottom of the hole, and you will find it will disappear if you have put enough heat around it.

It goes without saying that you should use a good cast-iron rod and flux. In making a heavy cast-iron weld, you can speed up the welding by welding three ¼-in. cast-iron rods together and welding three more on the ends of the first three and two on the ends of these for a handle. This keeps you away from the fire, and the flame will circle around and between the three rods and melt them in faster than if you used ⅜-in. or ½-in. rods.

If some special shape is desired in finish, or you want to take off some surplus metal, this can be accomplished by heating the top section with a torch and then scraping off with an old file.

If an overhanging part is required, place a piece of ⅛- or 3/16-in. strap iron underneath and weld to it. Remove the strap iron by heating the back side after the weld is completed and peel it off, leaving a smooth overhanging surface.

When the casting has been completely welded, add more charcoal if it has cooled off, and cover tightly and let cool completely in the charcoal. If the job is of long duration, you must keep enough charcoal in the furnace to keep the casting at a dull-red heat all during the welding. Do not uncover any more than is necessary. If this procedure is followed, you will get a nice soft weld—no failures, no strains and a perfect job.

The casting must be cooled evenly. This is especially important with castings having both large and thin sections, in order that the heat in the heavy sections will be dissipated into the thinner parts, and all parts of the casting will cool at the same time.

This same procedure applies to cast-iron boiler sections. A badly burned section will not flow freely, but should be burned through and cast-iron rods more or less brazed on to get good results.

Welding Teeth on Flywheel Gear.

Repairs Differential and Flywheel Gears

Welding teeth in differential and flywheel gears without their removal from the automobile, is the general practice of the Williamson Welding Works, 65 Eleventh St., San Francisco, Calif., according to Manager C. W. Story. There are 11 other Williamson plants operating at various points on the Pacific Coast, their specialty being "gear dentistry." The work is recommended for customers who prefer the less expensive plan rather than a new gear and the installation charge. As an expedient, where gears are not available at once or where the installation time of a new gear is longer than a welding job, the work is also recommended. Welders may use the idea with the cheaper cars, especially used cars bought at bargain prices from lots.

The car is first hoisted upon a tilting rack (the Williamson company uses one specially designed by them), and the lubricant is drained from the gear case. The teeth are manually turned into the proper position, just inside the inspection hole from which the plate has been removed. Grease is removed and the teeth fused on by the welding process using a carbon-steel electrode. The edges are then cut away with a suitable-width high-speed revolving abrasive wheel mounted on a flexible shaft. Welding is not the most difficult process. Dressing the new teeth to the exact dimension of the other teeth is an art requiring considerable practice. Neither calipers nor micrometers are used, the eye being employed in "trueing up."

The differential presents a number of problems in the matter of conforming the teeth. First comes the height—the easiest operation. Then comes spacing between teeth, which presents a tapered groove. The crown width and the toe width are equally as important as the taperings and slopes, each tooth being slightly different at one end from what it is at the other. It is a matter of practice and time, in the beginning, but once the method has been mastered, it is not the difficult task imagined, says Mr. Story.

The Williamson Co. advertises "one to two hours" service on teeth. It uses illustrated blotters showing a welder replacing teeth in a flywheel that has been made easy of access by the tilting rack and removal of part of the housing (see illustration). The average differential gear is more easy of access than the average flywheel, but both kinds are handled in large numbers by the company, which has been specializing for several years on "flywheel dentistry."

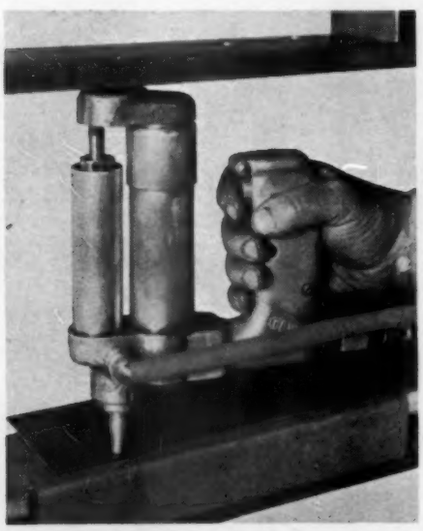
What's New in Equipment and Supplies

Portable Spot-Welding Gun Has No Cables

A very compact, portable hand welding gun has been developed by the Progressive Welder Co., 737 Piquette, Detroit, Mich., for sheet-metal assembly and fabrication. This gun is operated hydraulically, and is easy to handle because of the elimination of the heavy conductor cables.

The combining of the upper pressure bar as conductor bar and acting as back-up and support, simplifies and reduces fixture costs. The lower bar is the other lead to the transformer, and also serves as a loading table to locate and position the work. The transformer and booster are built into the fixture, making a more compact set-up.

The hydraulic principle of operation is said to result in perfect welds, as squeeze-action pressure insures the uniting of the parts to be welded, and "non-beat" timing does not complete the electric welding cycle until the parts are united, preventing premature, imperfect welds. The off-center mounting of the piston is said to decrease arcing and



Making Spot Welds With Hydraulic Gun.

flaring at the welding points, thereby materially increasing their wearing life or servicing periods.

For production fixtures, the gun can be equipped with various points and adapters, and with spade handle or regular grips, adapting it to most any shape, section or set-up.

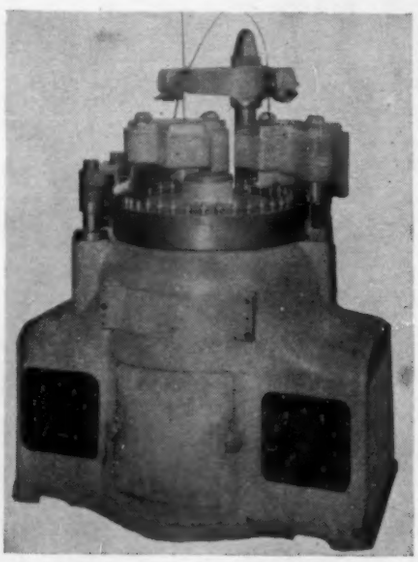
A. C. Welder for Light Work

A low-priced transformer-type a.c. welder capable of handling shielded electrodes up to ⅛ in. in diameter, has been announced by the Greyhound Manufacturing Co., 990 Atlantic Ave., Brooklyn, N. Y. The device is designed for operation from 110-volt a.c. power lines. For brazing, the machine can be used with a 3/16-in. carbon electrode. Six changes of power are provided.

Welding Machine for Production of Spark Plugs

A new type of electric welding machine, adapted especially for welding the side wire of spark plugs to the shell, has been announced by the Mechanical Engineering Service Co., Inc., 727 Insurance Exchange Building, Detroit, Mich.

The new machine, which stands about

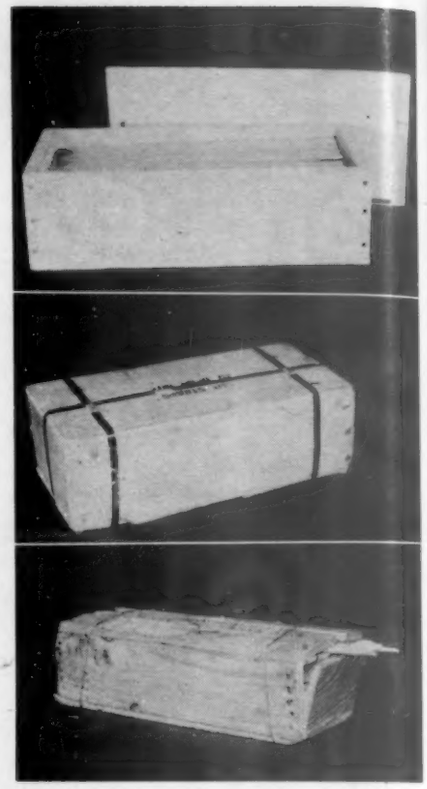


Machine Cuts Wire and Welds It to Spark-Plug Shell.

4 ft. high and weighs approximately two tons, has a rotary indexing table, two welding heads working simultaneously, and an automatic device to cut the wire to the specified size. The work is automatically ejected. The machine has an adjustable 8-position heat control. Although designed for especial use on sparkplug fabrication, with minor changes it can be used for other similar operations.

Steelstrap Makes Electrode Boxes Secure in Transit

The illustrations, furnished by the Acme Steel Co., 2840 Archer Ave., Chicago, Ill., tell an interesting story of how to cut down or eliminate damage in transit, of electrodes crated in boxes. "Steelstraps" over the sides and the ends of the box make a serviceable reinforcement. Moreover the lid need not be nailed, since the straps hold it firmly in place. The consignee needs only to snip



Electrode Containers, Before and After Testing in a Drum.

(The box is 14¼x6½x4 in. The top view shows the straps removed and the top lifted off. The two lower views shows the effects of nine falls in a testing drum. The box without reinforced ends was badly broken.)

the straps and lift up the cover to use the electrodes. As the cover is not damaged, it can be retained and the box re-used. The cost of the strapped box is only about one cent more than the other, it is claimed.

Metal-Spray Gun Has Wide Capacity Range

The "Universal" metal-spray gun, announced by the Metalspray Co., Inc., 113 Llewellyn St., Los Angeles, Calif.,

"Universal" Metal-Spray Gun.

is so constructed that all metals in any size of wire from 20 gauge B&S (0.032 in.) to ⅛ in. in diameter may be sprayed, obtaining the full range of the process economically with one unit. As the gun weighs less than 4 lb. it is equally convenient for hand or lathe operation.

A single-control valve, of monel and special bronze construction requiring no lubricant, permits turning on of acetylene, oxygen and air simultaneously. In addition, independent valves permit separate adjustment of acetylene and oxygen. An air-ventilated nozzle eliminates backfire. All ball bearings, gears and worms are lubricated from one point by an Alemite system. Worm and gear changes for varying wire speeds are made without removal of bearings or shafts. All bearing adjustments have been eliminated.

The power plant and combustion unit are completely separated, which, together with visible control of the wire-feeding wheels and external air-turbine exhaust, gives the necessary power, varying wire speeds and flexibility to handle the wide range of wire sizes in all metals melting up to 4800°F.

The weight of metal deposited per hour is in direct ratio to the wire size used. For instance, with ⅛ in., 12 gauge B&S, and 15 gauge B&S, respectively, steel is sprayed at 8, 5, and 2½ lb. per hour; bronzes at 15, 9, and 5½ lb.; and zinc at 32, 17, and 10 lb. Maximum gas pressures are: acetylene, 15 lb.; oxygen, 17 lb.; and air, 60 lb.

New Electrodes Designed for Fillet Welding

A new electrode which eliminates the necessity for multiple-pass welding in production of fillet and lap welds in many applications, and which permits production of such welds without undercutting or overlap, is announced by The Lincoln Electric Co., Cleveland, O. Fillet welds up to ⅜ in. in size, with one plate vertical, can be produced in one pass with the electrode. The welds show no undercutting at the vertical plate and no overlap at the horizontal plate, it is claimed. Fillet welds of any size can be made easily, of good quality and at high speed.

The new electrode, designated as "Fleetweld 8," is heavily coated for welding by the shielded-arc process. The welds produced are smooth and dense with notably high physical properties. A tensile strength of 68,000 to 72,000 lb. per sq. in. of the weld metal, as deposited, is claimed with 20% to 30% elongation in 2 in., and 30% to 36% elongation with stress-relieved coupons. Other properties, including resistance to fatigue, impact and corrosion, are equal to or better than mild steel.

"Fleetwood 8" comes in lengths of 14 and 18 in. The 14-in. lengths are made in ⅜, 5/16, ¼, 3/16 and 5/32 in. sizes, while the 18-in. lengths come only in the ⅜, 5/16 and ¼ in. sizes.

A. C. Welder Employs Novel Electric Circuit

An electric circuit never heretofore used in welder design is said to feature a new welder developed by James M. Weaver, of Monroe, Mich. This device, known as the Weaver "Andarc" welder,

Weaver "Andarc" Welder.

is being sold by the E & M Sales Co., 3050 E. Grand Blvd., Detroit, Mich.

This welder operates from 60-cycle circuits, and is said to give a current having the advantages of direct current combined with the advantages of alternating current. It is said to produce approximately 30% rectified current, yet employs no rectifying tubes, rotating parts, acids or chemicals, according to claims made.

Bare electrodes can be used as readily as coated electrodes, and it is further claimed that performance is not impaired even after the welder has been placed on a dead short for over four hours.

A positive switch gives 28 different welding heats and a long and short arc. The machine is said to be able to handle intricate jobs in any welding position.

Flux for Hard-Solder Applications

The Special Chemicals Corp., 32 Irving Place, New York, N. Y., has placed on the market "Spekflux," claimed to be a fast-acting hard-solder flux for soldering, brazing or welding stainless steel, steel, iron, copper, brass, bronze, platinum, gold, silver, monel metal, nickel german silver, and other metals and alloys.

"Spekflux" melts at a low temperature, resists evaporation at high temperature, and causes the solder to flow freely along the joint. Fluxing action starts at 212°F., and the flowing point is from 785° to 1600° F. and over.

"Spekflux" does not evaporate under high temperatures, and functions thoroughly and efficiently for high-melting-point solders; and it does not lump or pit solder, it is claimed. Under all conditions, the excess flux washes off quickly, saving cleaning time. The quick action of "Spekflux" saves both labor and gas. It is said to have no harmful toxic action. A descriptive circular is available.

Trade Literature

Applications of Toncan Iron in building construction, product design, air conditioning, railroads, marine service, and farms, are shown in a 20-page booklet published by the Republic Steel Corp., Advertising Division, Cleveland, O., and carrying the title "The Path to Sheet Metal Permanence." Rust-resistance, forming properties, weldability and other properties of this metal are discussed, and tables of plate and sheet sizes are included.

Hydraulic welding guns and equipment are illustrated and described in a pamphlet issued by the Progressive Welder Co., 737 Piquette, Detroit, Mich. Sketches show 30 different designs of spot-welding guns, and a number of applications are illustrated.

"Flexarc" motor-driven welders and bare generators are described in a recent bulletin of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. Applications, constructional features, specifications and performance curves for single-operator machines rated at 200, 300 and 400 amperes, are included.

The new "Universal" metal-spray gun, said to handle a wide range of wire sizes in a single tool, is shown and described in Bulletin 700, issued by the Metalspray Co., Inc., 113 Llewellyn St., Los Angeles, Calif. A table gives data on capacities, costs and thickness of coating for various sprayed metals and alloys.

The welding school of The Lincoln Electric Co., in Cleveland, O., is described in a pamphlet published by the company and entitled, "Building a Career in Arc Welding." The Lincoln

advanced welding courses, which have been held in many industrial centers in the United States, are also described.

Rules and conditions of the $200,000 prize contest being conducted by The James F. Lincoln Arc Welding Foundation are stated in detail in a 48-page book issued by the Foundation, P. O. Box 5728, Cleveland, O., from whom copies can be obtained by all interested in the competition.

A booklet showing their line of welding and cutting equipment and accessories, as well as pumps, has been issued by the Victor Equipment Co., of San Francisco and Los Angeles. Views of the Victor plants and of department activities, storage rooms, etc. are also shown.

Electrode holders, known as the Lincoln Type T and the Type HT (for heavy duty) are described and shown in Bulletin 321, issued by The Lincoln Electric Co., Cleveland, O.

A new price list of "Fuse-Well" welding rods of cast iron, cast iron moly-nickel content, cast iron coated (for arc welding) and cast aluminum, was recently issued by the Chicago Hardware Foundry Co., 337 Dearborn Bldg., North Chicago, Ill.

The new Weaver "Andarc" welder, which is said to give the advantages of both d.c. and a.c. welding without rotating parts or rectifying tubes, is described in a folder issued by the E. & M. Sales Co., 3050 E. Grand Blvd., Detroit, Mich.

Welding electrodes, plates, sheets, rolled shapes, boiler tubes, and boiler fittings and heads, are listed in a new thumb-indexed catalog issued by the A. B. Murray Co., Inc., 147 Wolcott St., Brooklyn, N. Y.

Pyrometers are described and their features enumerated in Catalog No. 15-C, issued by The Brown Instrument Co., Philadelphia, Pa.

Commercial News

Morrissey Heads P & H Weld Rod Sales

The Harnischfeger Corp., Milwaukee, Wis., announces the appointment of J. P. Morrissey as head of the Weld Rod Sales Division. He has had many years of sales and shop work both in the United States and abroad. Mr. Morrissey attained nation-wide recognition with his interesting article in the *Saturday Evening Post* concerning his experiences as Technical Welding Adviser for the Russian government in 1930. Besides his experience in Russia as supervisor of the welding of locomotives and parts in Voronezh, his former connections also include six years as special representative on weld rods with the Crucible Steel Co. of America and some time with the Fusion Welding Corp. as their Philadelphia district manager.

General Electric Displays Electrical Products

Welding, x-ray equipment, motors, distribution equipment, furnace brazing, and many other displays and demonstrations are being shown in an exhibit of electrical products for industry, in the General Electric Building, 570 Lexington Ave., New York, N. Y. Here is brought together, in 7,000 sq. ft. of floor space, a complete line of representative products of the General Electric Co. and its affiliates. Three arc-welding sets are demonstrated, and welding is carried on inside a welding booth. Among the many exhibits is one showing the steps followed in flash-welding blades to turbine diaphragms.

Compressed Industrial Gases Acquire New Properties

In connection with a report on dividends, in which their statement shows that earnings for the first two months in 1937 were more than double those of a year ago, Compressed Industrial Gases, Inc., of Chicago, also point out that on Jan. 1, 1937, they acquired Michigan Gases, Inc., of Grand Rapids, Mich., and in the latter part of 1936 the company took over the outstanding stock of Acetylene Gas & Supply Co., Inc., whose principal place of business is Detroit. In both of these transactions, additional shares of stock were issued by Compressed Industrial Gases. The company also has half ownership in the National Cylinder Gas Co.-Pacific Coast, located at Los Angeles, and recently started the construction of new oxygen and acetylene plants at Shreveport, La.

The Federal Machine & Welder Co., of Warren, O., was reorganized a few days ago. Two former Detroit men, Ross W. Judson and Paul O. Buckley, with E. W. Lucas, investment banker, and Royal E. Peterson, both of New York City, and F. P. McBearty and Mrs. Zella McBearty, of Warren, O., both of whom retain an interest in the company, form the personnel of the new organization. Mr. Judson was head of the Continental Motor Co., of Detroit, prior to 1929. Clark Nelson is president of the Federal company, with headquarters at Warren, O.

New appointments to the New York City and the Philadelphia sales staffs have been announced by The Lincoln Electric Co., Cleveland, O. The men appointed to the New York office, at 330 West 42nd St., are W. H. Borst, graduate in mechanical engineering from the University of Illinois, and E. A. Webber, formerly with the company's Chicago office. The new appointments to the Philadelphia office, at 401 N. Broad St., are William Sivyer, graduate of the University of Illinois, and B. B. Ross, graduate of Kentucky Wesleyan College.

Bert Fuchs, of the Fuchs Machinery Co., Omaha, Nebr., states the demand for electric welders has increased 30% since Jan. 1. Small portables take the lead at this time. Mr. Fuchs gives the reason: "So many small repair shops have just awakened to the possibilities of an electric welder for general repair, and found that more work can be done in a given time, and done better. This increases profits to the repair man."

The Wise Equipment Co., Detroit, Mich., has become distributor for the line of resistance-welding machines manufactured at Bay City, Mich., by the National Welding Machine Co. The Wise Equipment Co. was recently formed by Clarence E. Wise, with many years experience in this line, and formerly associated with Braisted & Baer.

A new oxygen plant, on Powhattan Ave., Essington, Pa., near Philadelphia, and a new acetylene plant, at 2330 Armistead Bridge Road, Norfolk, Va., have been opened by The Linde Air Products Co., 30 East 42nd St., New York, N. Y. Including these two, the company now has a total of 53 acetylene plants and 70 oxygen plants.

Idle since 1930, the old Hercules plant of the Harnischfeger Corp., on Robinson Avenue in Milwaukee, Wis., will be reopened as soon as repairs can be made. The company will move its growing electric-welding-rod division to the plant from its West Milwaukee factories, giving the firm badly needed additional space.

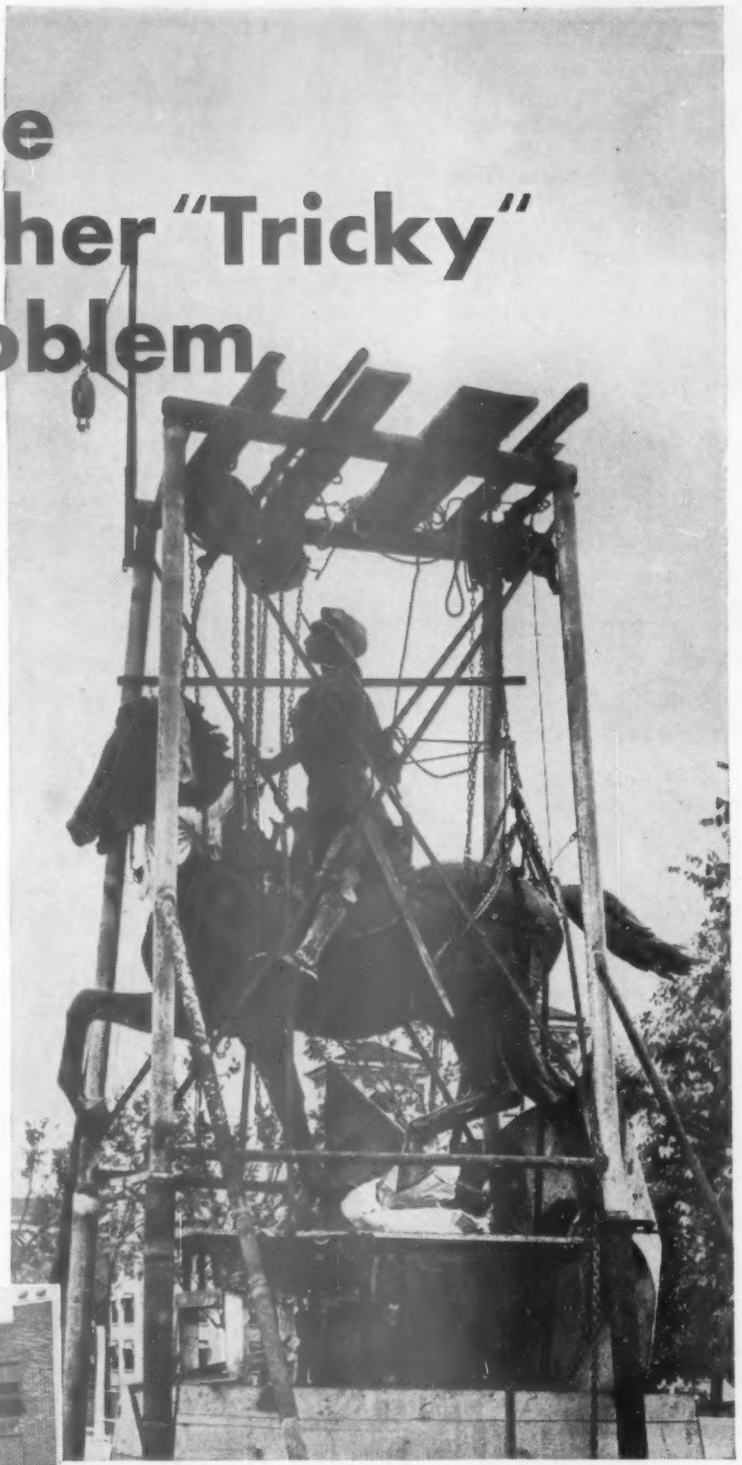
The F. G. Squire Co., Chicago, Ill., engaged in distributing and repairing oxyacetylene equipment, has opened a store at 4435 Madison St.

The Cincinnati, O., office of The Lincoln Electric Co. has been moved to Room 602, American Building, at Cen-

Tobin Bronze Solves Another "Tricky" Welding Problem

"I consider Tobin Bronze the strongest rod for low-temperature welding of any used in my 25 years of experience in the welding business."

—P. Wade, Weldit Co., Inc., Washington, D. C.



JEANNE D'ARC statue in Meridian Hill Park, Washington, D. C.
Cracks about the two hoofs which support the horse caused statue to lean at a dangerous angle. Repair consisted of lifting the statue about 3 feet off the stone, cutting off the base just under the horseshoes and bronzing it back into place with Tobin Bronze.

The hoofs are Red-Brass, and the base is a 3 x 6 copper plate, 5/8" thick, covered with an irregular 1/4" thick coating of Red-Brass, representing the ground. The difficult part of the job was to weld under the hoofs and obtain 100% strength, without spoiling the "natural" appearance of the statue or its finish. Tobin Bronze and good technique enabled Weldit Company to do the trick.

ANACONDA
from mine to you
37358

For quality jobs, experienced welders depend on Tobin Bronze. This time-tested Anaconda Welding Rod carries the trade-mark "Tobin Bronze Reg. U. S. Pat. Off." in each rod. Look for it—get the genuine!

Anaconda Welding Rods

THE AMERICAN BRASS COMPANY, General Offices: WATERBURY, CONNECTICUT
Offices and Agencies in Principal Cities . . . In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ontario

tral Parkway and Walnut St. Apologies are due The Lincoln Electric Co. for the error in the March issue of *The Welding Engineer* which reported the Cleveland office as having moved.

Porter D. Scott has been appointed district sales manager of the Pittsburgh district by the J. D. Adams Co., Indianapolis, Ind. Mr. Scott formerly represented the Keasbey-Mattison Co., of Ambler, Pa., in welding-electrode sales.

The St. Paul Welding & Manufacturing Co., of St. Paul, Minn., recently moved from 174 W. Kellogg Blvd. to 292 Walnut St. Its new quarters, erected by them, is about 60x130 ft.—a thoroughly modern shop.

Charles H. Jarvis, 47, designer of a number of automatic welding and wire-forming machines, died at his home in Battle Creek, Mich., Feb. 23, following a brief illness. Mr. Jarvis at the time of his death was factory manager and a director of the United States Steel & Wire Co., of Battle Creek.

C. L. Shipley has been appointed representative in the Pittsburgh district for The Champion Rivet Co. Mr. Shipley has been connected with the Champion company for ten years, having served in both the operating and sales divisions at the company's headquarters in Cleveland.

Don McCormick, formerly welding supervisor for the Sheffield Steel Co., of Kansas City, Mo., has been appointed arc-welding consultant for the Kansas City, Mo., office of The Lincoln Electric Co.

Notes From the Field

W. Wilson and C. F. Carroll, proprietors of Norfolk Machine Co., 1611 Goodfellow Ave., St. Louis, Mo., have been confining their business almost entirely to work done on contract for a local manufacturer of restaurant equipment, consisting chiefly of machining and welding of gas-tight joints for gas cookers. According to Wilson, they weld as many as 100 gray-iron castings a week. They are called on from time to time to make changes in the manufacturer's models, and in this connection they have been instrumental in saving the latter several hundred dollars during the past year. As an instance, the manufacturer recently desired a change made in a gas fryer that was unsatisfactory owing to the fact the bakelite top of the thermostat cracked from heat emanating from the burner. It was his wish that the end casting be lengthened so that the thermostat would be farther removed from the flame. Wilson says they cut the end casting with a hack saw and spliced in a piece with the oxyacetylene torch, thus effecting the change at a cost of $2.50 to the manufacturer—a saving of $10 over the cost of having a pattern made.

B. J. Hegeman, proprietor of the Arlington Welding Co., 4908 Easton Ave., St. Louis, Mo., specializing in the welding of motor blocks, takes advantage of the fact that five used-car dealers are located within a few blocks of his shop. When his business is slack, he goes from one to another of these merchants in second-hand vehicles, soliciting additional jobs. During his busiest period, he repairs from six to eight blocks a day. The most difficult phase of this work, he says, is the welding of blocks of the 1929 to 1931 models of a certain car in the low-price field. Invariably the break is in the underneath portion of the block, adjacent to a drain plug, and the welder is forced to lie under the car to make the repair. This particular car is equipped with two drain plugs, and failure of the automobile owner to open the plug at the base of the block, when draining during freezing weather, is responsible for subsequent damage to the block.

The General Welding Co., Pittsburgh, Pa., of which D. O. Smith is president, recently completed building an all-welded steel door which, according to Mr. Smith, is the largest of its kind in the United States. The door is now in use on a new hangar at the Allegheny County Municipal Airport, near Pittsburgh. It is of the overhead type, and is made in two sections, each 75 ft. wide and 80 ft. high, making the over-all size 150x80 ft. A steel girder framework was first erected, and then steel plates, measuring 12x4 ft., were welded on. County officials were well pleased with the job, reports P. J. McDonough, welding engineer for the General company. Doors of this type usually are riveted, and the welded construction of the door makes for a smoother appearance.

Two all-welded paint-mixing tanks, 48 in. high and, roughly, 6 ft. in diameter, were recently completed by the American Iron-Steel Manufacturing Co., 4920 Easton Ave., St. Louis, Mo., for a local paint manufacturing company. The tanks represent a departure from conventional paint-mixing vessels in that the bottom and top sides curve inward. The curved bottom, according to George Frankey, president of the American company, facilitates cleaning of the vessel, while the in-curving top prevents paint from splashing out. Mixing of the paint is effected by a portable agitator clamped to the top of the tanks. Frankey's concern also recently made an all-welded structural steel walk, 40 ft. in length and 6 ft. wide, which was installed in the paint factory at a height of 24 ft. above the floor, partially encircling four paint-mixing tanks that repose on angle-iron stands.

The Dravo Corp., of Pittsburgh, Pa., who pioneered in the construction of the single-screw tunnel stern towboat *Pioneer*, described in a recent issue of *The Welding Engineer*, have started work on two vessels of the same type at their Neville Island, Pa., shipyards. These boats will have all-welded bows. Although not new, the idea of a model bow for boats was used by the Dravo Corp. on the *Pioneer* and this type was found to be of considerable advantage in developing greater speed, while none of the pushing power has been impeded. The two new boats will be identically the same as the *Pioneer*, and will be powered with internal combusion engines of 250 hp. rating.

An unusual job of welding and repair was recently completed by the Cain Electric Co., 2724 W. Third Street, Dayton, O. A large electric sign, hanging in front of a downtown filling station, was badly damaged by a big truck, which climbed the curb and sideswiped the lower end of the sign. Since it was not practicable to take the sign down, it had to be repaired as it hung, the lower end being some twenty or more feet above the ground. It was necessary to straighten several support bars, weld others, and straighten and repair the outside paneling before any work could be done on the neon tubes comprising the electric lettering on the sign.

A paraffin-distillate tower, with an overall height of 91 ft. 9½ in., an outside diameter of 18 ft. 7½ in., and a total weight of 225 tons is being erected by the Graver Tank & Manufacturing Corp., East Chicago, Ind., at a refinery near Chicago. The tower was shipped to the site in 34 sections, each section composed of ¾-in. plate butt-welded in the Graver shop. The field joints were assembled with single butt straps, riveted and seal welded.

Geo. W. Evans, secretary of the Burroughs Adding Machine Co., Detroit, Mich., offers the following correction to a report printed in the January issue of *The Welding Engineer*: "The Bur-

Gain your **GROUND** with a Lever

Archimedes is credited with being the first to realize the enormous power that can be exerted by means of a lever. "Give me a place to stand and to rest my lever on," said this ancient Greek, "and I can move the earth." His was a MECHANICAL LEVER.

◆

Eighteen years ago, a group of 100 "Archimedes" started to build what is today the *idea lever* of a husky, growing industry.

Fully developed and in efficient use, the American Welding Society today offers a powerful hand to individuals who are anxious to get ahead in the technical side of welding.

Representing the welding interests of practically every major user of welding, this organization is right in the thick of things. Membership enables you to keep abreast of developments in this industry that's going places so fast.

As a production executive, you can benefit by the discussions and write-ups on short-cut procedures and cost-reducing methods developed by the users of welding—large and small.

As an engineer or draftsman, you will be able to incorporate new-found designs for better products and lower cost production. A. W. S. membership includes hundreds of trail-blazing design-minded engineers.

As a welding or cutting operator, you have the opportunity of a life-time to become familiar with the problems and their answers which you will encounter in your rise to a higher position. Yours too are the many important discoveries in welding and cutting procedures, affecting the quality and speed of your immediate work.

Cost of membership in the A. W. S. is negligible compared to the vantage point which it can give you for a profitable career. Why wear yourself out and then maybe not make the grade when such a powerful leverage is at hand?

For further information about the society, address: American Welding Society, 29 West 39th Street, New York, N. Y., or A. F. Davis, Chairman Membership Committee, P. O. Box 5758, Cleveland, Ohio, or the publishers of this magazine.

Join the —

★ AMERICAN WELDING SOCIETY ★

for **ADVANCEMENT**

roughs Adding Machine Co. has never at any time had any broken parts of its machines welded by the Dayton Welding Co., nor does the Company make a practice of using such welded parts when building, repairing or rebuilding any of its machines. The accuracy and the reliability required of Burroughs machines preclude the use of anything but parts as originally produced that have been subjected to the prescribed factory tests."

When the Water Division of the City of St. Louis recently set about the work of running a water main beneath the tracks of the Wabash railroad at the DeBaliviere Avenue viaduct, the contract for making bends in the 36-in. pipe was awarded to the Lutke Welding & Boiler Repair Co., 709 S. Taylor Ave. Lewis W. Lutke, proprietor, says that two 30° and two 45° bends were made and that four welds were made on each bend. Four angle irons were welded to each end piece of the 5-piece bends, or eight to each bend. Part of the work was done at the Lutke shop and part in the tunnel 15 ft. beneath the railroad tracks.

An order for a 60-ton electric overhead traveling crane has been placed with The Cleveland Crane & Engineering Co., Wickliffe, O. The crane is to be mounted in the dome of the 200-in. telescope building at the California Institute of Technology, Pasadena, Calif., for handling the delicate parts of the world's largest telescope. To eliminate any possibility of connections loosening, and provide greatest possible strength and rigidity, all-welded steel construction will be employed throughout. A 5-ton auxiliary hoist will be provided for handling of small loads.

Paul B. Hughes, owner and operator of the Soto Welding Works, near 23rd and Soto Streets, Los Angeles, Calif., recently completed a nice piece of work in the installation of a new electric welding generator in a new Dodge truck. The generator is hooked up to a special power take-off, and driven by the truck motor. Mr. Hughes has also a neatly arranged portable frame for carrying oxygen and acetylene tanks while on field jobs. This frame is cut out of boiler plate and welded together in such a way as to prevent the tanks from rolling about in the truck.

An enrollment of 76 students is reported by W. A. McCollum, proprietor of the Atlas Aluminum Welding Co., 2913 N. Broadway, St. Louis, Mo., who conducts a school of welding in conjunction with his job shop. This represents an increase of 60% over the number enrolled last year. Seventeen acetylene units and 12 arc-welding machines are in use in the school, and installation of additional equipment is planned. In five weeks, Mr. McCollum reports, he secured employment for 35 men who had completed the welding courses.

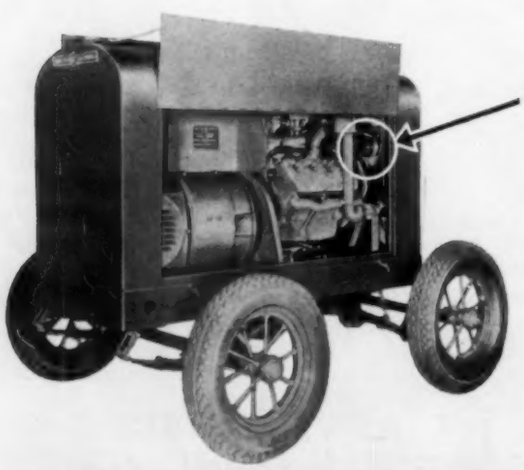
W. P. Donlin, owner of the Portable Welding & Boiler Repair Works, has moved from his old location at 58 Broad St., Binghamton, N. Y., to 30 Crocker Ave., Johnson City. His growing business required increased accessability and parking facilities, and he has these at his new location. Working on a contract for the Underground Pipe Co. of Boston, Mr. Donlin has 90 hours of welding to do at the Agfa Ansco film plant. The company has just completed making three all-welded boilers of 8, 10 and 20 hp. rating for apartment-house service.

Bids on four immense all-welded spheres for oil storage purposes are being taken by the Humble Oil Co., Baytown, Texas, giant Standard Oil Co. subsidiary. These spheres have unusual construction features. One of them will be 37 ft. 9 in. in diameter and will be designed for an internal working pressure of 100 lb. per sq. in., necessitating that it be made of 1¼-in. plates, butt-welded. The other three spheres will

General Electric Selected the Pierce Governor—

Why? They Satisfy . . .

You too will be satisfied with the Pierce Governor, just as General Electric, and many other manufacturers of arc welders are. They know that good arc welds are possible only when there is perfect current control. Hobart Bros., Lincoln, USL, Electric Arc, Wilson, are all Pierce equipped.



The heart of any gasoline-engine-driven arc-welder is the governor, which must have instant response and perfect control over the power unit to insure good welds.

Centrifugal (or flyball) governors surpass all other types for regulating machine speeds. Supreme in this field is the Pierce Universal Governor.

If you are building your own welder with a new generator and a used auto motor, be sure to equip the engine with a Pierce Universal Belt Driven Governor. Planned especially for the shop-assembled welding unit, this fits any engine and operates with a flat or V-type belt.

Write today for literature and prices

PIERCE GOVERNOR COMPANY
ANDERSON, INDIANA, U. S. A.

be 51 ft. 3 in. in diameter and for 50-lb. internal working pressure; they will be made of ¾-in. plates, butt-welded.

The U. S. Army Engineers at Pittsburgh, Pa., will open bids April 28 for the construction and delivery of two 15-ton locomotive-type cranes for use on the Emsworth, Pa., dam situated at Emsworth on the Ohio River. The construction of these new cranes involves considerable welding. The total operating weight of these cranes, which are to be equipped with booms 50 ft. long, is 30,000 lb. on a 12-ft. radius and 5,000 lb. on a 50-ft. radius. Delivery is to be made at the United States boat yards in Charleroi, Pa., within 180 days.

A large volume of all-welded floating equipment for inland waterways is being turned out these days at the Neville Island, Pa., shipyards of the Dravo Corp., of Pittsburgh. One day recently six vessels were placed in the river, indicating the splendid facilities which the Dravo Corp. maintains for speeding up production of all-welded equipment. Work was recently started on a fleet of four welded flush-deck type of cargo barges, each 100 ft. long, 26 ft. wide and 6.6 ft. deep.

David J. Linden has taken over the welding shop at 315 W. Larned St., Detroit, Mich., which for the past twenty years has been operated by John Knowland. The shop is being moved next door, to No. 317, and is being tripled in size. The present plans call for installation of an additional arc welder, torches and other equipment. The business will be renamed the Marine Welding Co. and Linden plans to specialize in work for the various navigation lines upon the Great Lakes.

Dr. Alfred Douglas Flinn, director of the Engineering Foundation, died on March 14 at Scarsdale, N. Y., after a prolonged illness. He was 67 years old. Among his many achievements was his work, in conjunction with the National Research Council, in developing and financing the Fatigue of Metals Research and other investigations, and in establishing, also in conjunction with the Council, several research bodies, including the American Bureau of Welding.

Recent heavy rains in the Tehachapi Mountains north of Los Angeles caused heavy landslides, resulting in much damage to gas lines, and as a consequence, welders and their helpers have been kept busy making repairs along the large transmission lines which cross these mountains bringing natural gas from Kettleman Hills to Los Angeles. It is reported by the welders that the welds

Sil-Fos

gives

life-time strength

to heating elements in unit heaters

The heating element is the very heart of a unit heater. The joints between the tubing and headers or return bends used in constructing them must be permanently tight. To assure this and the trouble-free operation which results, McCord and other well known makers use SIL-FOS . . . because

- **SIL-FOS gives high joint strength—as high or higher than the metal joined.**
- **Ductile SIL-FOS joints stand up reliably under wide temperature changes and constant vibration.**
- **SIL-FOS, free-flowing at the low temperature—1300 deg. F.—makes sound joints without damaging the physical qualities of metals.**
- **SIL-FOS assures economy—a small quantity does a perfect job . . . the low brazing temperature saves time, gases and speeds up production.**

TRY SIL-FOS

on your non-ferrous work

Use it with our low temperature Handy Flux. Together they work equally well on thin or heavy gauges, on production or special work. Write us for full details and BULLETIN 54-W.

HANDY AND HARMAN
82 Fulton St., New York

in the lines stood up remarkably well in practically all the broken areas.

The Dravo Corp., of Pittsburgh, Pa., recently sold a flush-deck-type sand-and-gravel barge to the American Aggregates Co., of Greenville, O., for service on the Ohio River. The barge is 135 ft. long, 27 ft. wide and 8 ft. deep. It will be used for general haulage purposes on inland-waterway freight service.

When a crawler-type steam shovel recently refused to function, due to badly worn sprocket and lugs, W. E. Byers, owner of the Greenville Welding Works, 311 Falls St., Greenville, S. C. was called in on the job. He assigned four arc-welding operators to make the necessary repairs on the spot, which was done in less than four days and at a cost of $460 to the contractor. In building up lugs and sprockets, 350 lb. of manganese steel was deposited.

When the seat of an 800-lb. steam valve at the Biddle Street branch of the Union Electric Light & Power Co., St. Louis, Mo., broke loose, the job of welding the seat back in place fell to Anthony Kalz, president of the Peerless Welding & Cutting Co., 3205 N. Broadway, who heated and brazed the job in 6 hours. Because of the size and shape of the valve, it was necessary for Kalz to improvise a special long-necked torch to make the repair.

Adoption of specifications that would permit welding in steel bridges, was recommended in the report of the Committee on Iron and Steel Structures of the American Railway Engineering Association, given at the convention of the Association in Chicago, March 16 to 18. The Committee also suggested that additional research be made to provide more complete information on the behavior of welds subject to stress.

The El Paso Natural Gas Co. is starting work on three laterals, chiefly to supply natural gas to copper refineries. These will comprise an 8½-mile, 6-in. line from Whitewater to Hurley, N. M., a 21-mile, 4-in. line near Lordsburg, N. M., and a 46-mile, 6-in. line from Redrock to Hayden, Ariz. All lines will be gas welded, according to an announcement from The Linde Air Products Co., New York, N. Y.

The new Wilmington oil field in Southern California is the scene of much welding activity at this time. A program calling for the employment of considerable welding in this area is that of the General Petroleum Corp., in the construction of a new 10,000,000-cu. ft. casinghead-gas absorption plant near Anaheim Road, and the drawbridge in the harbor. The cost will approximate $300,000.

Welders of the Pittsburgh-Des Moines Steel Co. have been at work since March 22 building two large butt-welded elevated pressure liquid holders for the Lone Star Gasoline Co., of Breckinridge, Texas. These holders will each be of 10,000 barrels capacity and will be used for storing oil in the form it reaches just before being converted into gasoline. They will be 40 ft. in diameter and 25 ft. high. The tops and bottoms will be in the form of hemispheres and will withstand a pressure of 25 lb. per sq. in. It is expected that the work will be completed by May 15.

L. B. Thomas, owner of the Economy Welding Co., 18th and Cuming Sts., Omaha, Nebr., has purchased a new arc welder which he will mount on a 10-ft. trailer and will be used mostly in repairing furnaces. This shop does many repair jobs on gasoline and oil tanks, mounted and unmounted, which work has grown until it takes all the time of one welder and two mechanics.

R. P. Olsen & Son, 21st and Cuming Sts., Omaha, Nebr., who started out as a blacksmith shop, later adding an arc-welder for repairing motors of freight-

FREE SAMPLE
ROL-MAN
Mr.
Company
Address
FILL-IN AND MAIL TODAY
ONE TRIAL
will Convince You
there IS a difference
Where resistance to IMPACT—ABRASION is required, nothing compares with ROL-MAN, the pioneer Manganese Steel Welding Rod. Tough-hard, Strong, Wear Resisting Welds are easily laid on cast, forged or rolled, carbon or alloy steel parts. Purity of the ROL-MAN True (11% to 14%) Manganese Steel Rod, together with its special coating insures a smooth free-flow and produces a clean, even weld, without checks or cracks. Fill-in the "tag" at the top of the advertisement and mail it to us. Try the sample we send you (without obligation) and give the weld any test. We feel sure you'll agree that ROL-MAN is different.
True Manganese Steel
MANGANESE STEEL FORGE CO., BUTLER & RICHMOND STS., PHILA., PA.

hauling truckers, has now gone in for building all-metal truck bodies; one just completed being the largest ever made in Omaha. It will be used in furniture hauling, and the body is virtually one piece, being an all-welded job.

The Smith School of Welding, 250 West 54th St., New York, N. Y., this month celebrates its tenth anniversary, by announcing that spot welding will be added to its instruction courses. A.c. welding equipment was recently added, bringing the total number of electric welders to six; 15 oxyacetylene torches are also employed in instruction. The school, which completes a decade at the same address as when founded, but occupying greatly increased quarters, currently reports the largest enrollment in its history.

The Watson Transfer Co., Inc , operates over 150 trucks between Omaha, Kansas City and Chicago, with occasional loads going to Minneapolis and some as far as New York. Ray Watson, president of the company, states that their arc-welding machine has paid for itself three times over since its installation a year ago. Now the company does all its welding in its own shop.

The Independent Erector, published by the Independent Steel Tank and Plate Erectors Association, Inc., 6417 Ingleside Ave., Chicago, Ill , blossomed out in its March issue with a new size—4x9 in.—including 12 mimeographed pages of news and four pages of pictures—the first time pictures have been used in this publication, which goes to all members of the association.

The Johnson Airplane and Supply Co., 445-451 East 1st St., Dayton, O., general welders and airplane supply depot, have begun building as a sideline a hollow-rail light luggage carrier, which is being marketed under the trade name "Exceso." Johnson's specializes in the building-to-order of platform trucks and reports quite a sizable increase in this type of business.

Twenty-eight years ago, W. C. Petty, consulting engineer of the Central Machine & Boiler Works, Inc., Lexington, Ky., started his first job as a welder. Mr. Petty has always been one of the pace-setters in the field, and is now known as one of the best welders in Kentucky. He estimates he has welded $25,000,000 worth of material during his lifetime.

The School of Aircraft Welding has been started at the Municipal Airport in the Abrogast airdrome at Long Beach, Calif., by Glenn L. Abrogast, well known in the aircraft industry and operator of repair station No. 160 of the U. S. Department of Commerce, and Edward Neff, formerly director for Consolidated Aircraft, Inc., at Buffalo and San Diego.

H. L. Hobbs, proprietor of the H. L. Hobbs Repair & Machine Shop, 116-118 Water St., Johnson City, Tenn., recently completed a contract with the North American Rayon Corp., Elizabethton, Tenn., one of the largest rayon-thread manufacturers in the United States, for welding 41 3-deck cars to transport rayon thread between departments.

The New Ideal Welding Co., 344 S. Main St., Dayton, O., has hired several new employees, owing to a recent increase in business. Gene O'Neill, manager of the company, has been conducting a steady advertising campaign, laying stress on the low cost of welding repair when compared with the purchase of new parts to replace broken ones.

When the Monarch Tank & Metal Fabricating Corp., Lackawanna, N. Y., moved its entire plant and equipment to Perry, N. Y., recently, they added four new arc welders to their plant equipment, there being two 500-ampere trans-

Photo Courtesy St. Paul Hydraulic Hoist Co.

-St.Paul- HYDRAULIC HOISTS - BODIES

There Must Be a Reason...Why Ryerson No. 217 Electrodes Are Preferred

● The Dump Truck Body shown above was fabricated from 10-gauge sheet steel by arc welding with Ryerson No. 217 Electrodes. No bolts or rivets were used. The manufacturer, the St. Paul Hydraulic Hoist Co., is but one of several leading manufacturers of truck bodies who use Ryerson No. 217 Electrodes exclusively.

Ryerson No. 217 Shielded Arc Type Electrodes are fast and economical. They have a very low spatter loss and the ease with which the slag is removed makes them ideal for jobs requiring a good paint finish. Write for bulletin which gives data on these and other outstanding Ryerson Electrodes. Address the nearest Ryerson plant.

Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Cleveland, Cincinnati, Detroit, Boston, Buffalo, Philadelphia, Jersey City

RYERSON

former sets and two 300-ampere motor-generator sets.

Contracts were approved the week of April 7 for repairing of the steel hull and the boiler of the U. S. Engineers' dipper dredge *Beaver*, of the Pittsburgh District. The Dravo Corp., of Pittsburgh, was awarded the work, which involves much welding. The hull, as well as many of the interior parts of this dredge, are of welded construction.

The Saunier Bros. Iron Machine & Boiler Works, Lexington, Ky., has found welding work on hand lawn mowers a profitable sideline. When the grass begins to grow in the local back yards in the early spring, the Saunier shop is besieged with orders for minor welding work on hand mowers. This business continues throughout the summer.

A pyramidal cover, 24 ft. in diameter, weighing approximately 5 tons, was recently fabricated by welding, to replace a cover on a gas purifier at the Binghamton (N. Y.) Gas Co. plant. This cover was fabricated in the shop of the Binghamton Foundry & Machine Co., Inc., 2 N. Floral Ave., and was delivered in one piece to the job.

Everyone connected with the Central Machine & Boiler Works, Inc., Lexington, Ky., is smiling now. The reason is a 30% increase in the business of March over that of March, 1936. This sudden increase more than wipes out the 4% decrease in business noted during the first two months, as compared with the first two months of last year.

Glenn Deats, of Plymouth, O., has opened up a fully equipped shop to handle electric and acetylene welding at 44 Plymouth St. He has installed portable equipment and at the present time is engaged in making a special appeal to farmers to look over their machinery and have it in readiness and good repair for the season ahead.

The General Welding & Engineering Co. moved recently from 1455 Niagara St., Buffalo, N. Y., to larger quarters at 1338 West Ave. in the same city. This organization specializes in building airplane parts for various aeronautical organizations throughout the country. The company has done work for the U. S. Army Air Corps.

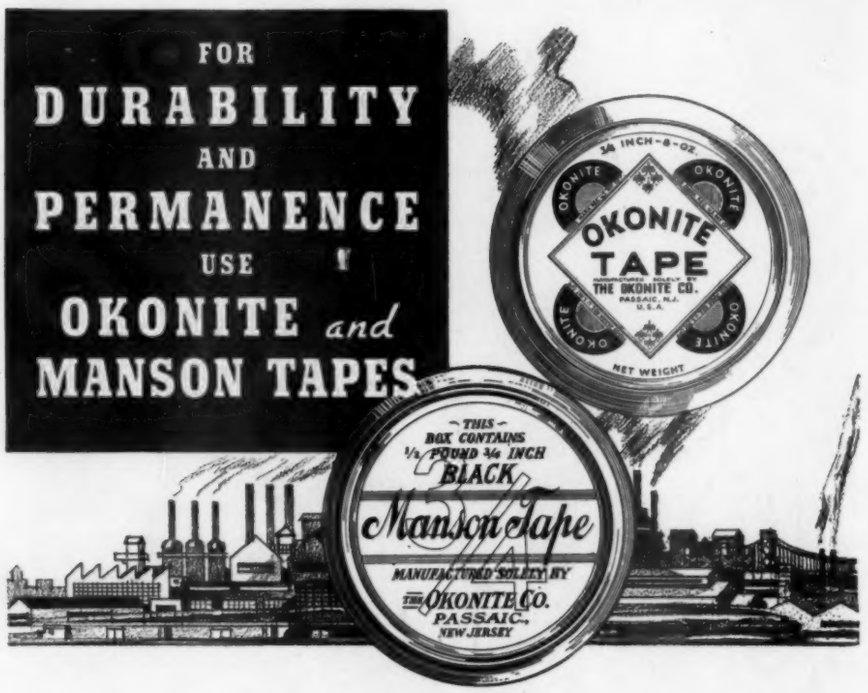
Six firms recently submitted bids for the construction of a group of oil barges for the U. S. Army Engineers of the St. Louis district. The bids were taken on 5, 6, 7 or 8 all-welded barges. The Ingalls Iron Works, of Birmingham, Ala., submitted a low bid of $15,165 for each of the eight barges with delivery in 115 days.

Both main bearings on a 4-ton press frame, which had been broken, were recently preheated, welded and annealed by the Miller Welding Co., 1213 Summit St., Toledo, O. This was a 14-hour job. Mr. Miller, the proprietor, says that the welding of structural steel is becoming an increasingly large item in their business.

A school for training welders has been started by the Toledo Welding Co., 111 Eleventh St., Toledo, O., according to Arthur Rack, proprietor. This company recently repaired a 4-ton punch press for the American Can Co. of Toledo. This press was broken in two places and required two welds, about 8 and 10 in. long.

By cultivating the trade of the surrounding farming regions, the Lexington Engine & Boiler Works, Lexington, Ky., have added 30% to their business. Many orders for welding all sizes and types of farm machinery are handled by them. Farm and automobile work now provides the bulk of their business.

Charlie Jones, who runs a welding and repair shop out on R. F. D. 2, Dayton, O., is now doing the welding for several individuals and companies engaged in the construction of auto trailers. His new automobile is evidence of the profitableness of this work.



The word OKONITE or MANSON on a roll of tape means that under all manner of conditions, in every kind of weather and service, these tapes stand the siege of time. Day in and day out, year in and year out, these tapes last. They last, in fact, just as long as the insulation on the wire itself.

The lifetime of a splice made with OKONITE and MANSON Tape is, therefore, equal to the lifetime of the wire. Durability, permanence—factors of true economy in the maintenance of your lines—are thus assured when you specify:

OKONITE TAPE—a rubber insulating tape, made of highest grade rubber and compounding ingredients that form a homogeneous mass of high dielectric strength and impervious to moisture.

MANSON TAPE—a rubber filled cloth tape for the mechanical protection of joints. Made by true friction method, this protective tape is unequalled in its adhesive qualities and length of service.

Write for samples and our booklet, "Splices and Tapes"

THE OKONITE COMPANY
Founded 1878
and
HAZARD INSULATED WIRE WORKS DIVISION
THE OKONITE-CALLENDER CABLE COMPANY, INC.
EXECUTIVE OFFICE: PASSAIC, N. J.
New York · Boston · Chicago · Detroit
Philadelphia · Pittsburgh · Washington · San Francisco
Los Angeles · Seattle · Buffalo · Dallas · Atlanta
Factories: Passaic, N. J. · Wilkes-Barre, Pa. · Paterson, N.J.

Two all-welded fuel-oil pressure tanks were recently installed by the Filtered Fuel Oil Corp., Brooklyn, N. Y. These tanks, which are rectangular in shape, are 60x80x10 ft. in size. The steel was fabricated at the Neville Island (Pa.) plant of the Pittsburgh-Des Moines Steel Co. and welded on the job.

Experiments in welding jutting ornamental strips to automobile doors without dismantling the door and without warpage are being conducted by the Auto Renewal Co., 520 W. Market St., Johnson City, Tenn. Lawrence L. Nave, proprietor, expresses confidence the experiments will be successful.

Jack Pfaff, owner of the Binghamton Welding Works, 71½ Henry St., Binghamton, N. Y., conducts an oxyacetylene school each winter. This year's class of 16 members completed their training at the beginning of April. Since the inauguration of his school, Mr. Pfaff has trained nearly 400 men.

The Barnsdall Pipe Line Co. has let a contract for a 70-mile, 6-in. oil line in Texas to Williams Brothers Corp. The line will connect with the company's refinery to be built near Corpus Christi. Gas welding will be used, according to a report from The Linde Air Products Co., New York, N. Y.

The Lexington Boiler & Engine Works, Lexington, Ky., recently received a contract from the Gulf Oil Co. for the production of two welded steel tanks, 10 ft. long and 16 ft. in diameter, and containing two separate compartments, to be installed at the company's branch at Berea, Ky.

Probably the oldest arc-welding machine in Omaha is that being operated by Sam Friedel, 929 North 24th St. This was the first welder in Omaha to be used on motor repairing, and was bought and installed in 1914. It has been used exclusively for that purpose during its 23 years of service.

The Crum-Brainard Co., of Whittier, Calif., employing a large crew of welders in the manufacture of various types of oil-field tools, recently expanded its welding-department facilities by the addition of three new welding booths, together with the installation of new equipment.

The Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa., recently received a contract for the construction of an all-welded elevated steel water tank for the municipal water supply system at Aberdeen, S. D.

C. H. Dahl & Son, Alta, Iowa, doing a general repair business on farm machinery and automobiles, has gone in for welding, having recently installed a 200-ampere arc welder. Alta has less than 1,000 people, and the Dahls expect fully half the jobs to come from motor work.

The Pennsylvania Engineering Co., of New Castle, Pa., are building an immense all-welded dust catcher at the Carrie furnaces of the Carnegie-Illinois Steel Co. at Rankin, Pa. This large device is being fabricated from ⅝-in. plates, all of which are lap-welded.

The deck of a tug, measuring about 125x25 ft., was recently welded by the Hans Hansen Welding Co., 318 Washington St., Toledo, O. This company also recently constructed a self-supporting stack, 49 ft. high, made of 3/16-in. steel plate welded in 5-ft. sections.

Titchener Iron Works, 23 Griswold St., Binghamton, N. Y., recently repaired a leak in a large storage tank for the Pure Oil Co. John B. Delavan, prominent in Republican political circles and formerly a member of the local board of aldermen, is general manager.

An order involving a large amount of aircraft welding was recently placed by the U. S. Government with North American Aviation, Inc., of Inglewood,

COLMONOY
SWEAT-ON
Now in
PASTE FORM

- **EASY TO APPLY . . . just squeeze the collapsible tin tube, and spread with spatula or brush—**
- **NO DELAY . . . because the handy tube is always ready to use, and the paste dries with moderate heat—no need to wait to air dry—**
- **NO WASTE . . . because you apply exactly the desired amount from the tube.**
- **ECONOMICAL . . . a single one-quarter pound tube will hard face from one to three square feet depending upon thickness of overlay—and costs only $2.25.**

SWEAT-ON Paste in larger quantities is furnished in cans — prices on request. COLMONOY SWEAT-ON is still furnished in dry, crystalline powdered form if specified.

•

Send for THESE **FREE** BOOKLETS!

Now Available From Our Distributors in Principal Cities, or . . .

COLMONOY, INC.
LOS NIETOS CALIFORNIA

COLMONOY